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THE PROPOSED ASSOCIATION OF CONSULTING ENGINEERS.

WE have received from the Hon. Secretary a circular which sets forth the *raison d'être* of the above proposed Association, and also gives the reasons which have prompted the promoters to limit the membership to corporate members of the Association of Civil Engineers. We must confess, however, that we are not greatly impressed by the reasons given, which are scarcely consistent with the avowed objects which the promoters have in view; nor, in fact, do the objects themselves appear to be strictly consistent with each other. One of the principal objects, we are told, is to secure that municipal and other public works shall be supervised by duly qualified consulting engineers, and it is hoped that the register of the Association will serve as a means of ascertaining who is a qualified consulting engineer. It would appear from the foregoing that secondary importance is attached to consulting work which does not touch municipal and other public works, whereas it is possible that at the present time this does not constitute the principal work on which consulting engineers are engaged. Such work, for example, as the electrification of collieries, ironworks, textile and other factories, and the various undertakings of consulting mechanical and gas engineers, frequently require a wider engineering training than is necessary for the designing of an electric power station for municipal or public works, and consulting engineers engaged in these diverse classes of work would certainly not consider themselves to be on a lower plane than consulting engineers who had specialised in municipal work. It is the intention, according to the circular before us, "to include in the Association all branches of the profession, namely, civil, mechanical, electrical, gas and possibly others, although it is not suggested that every member shall possess a knowledge of more than one of these branches." This being so, it is all the more difficult to understand why membership is to be confined for the present to those who are corporate members of the Institution of *Civil* Engineers, and also of the Institution representing the principal branch of the profession in which they practice. The only reason which is given for this requirement is that the Institution of Civil Engineers has taken the lead in examination for admission, and has in many other ways taken great pains to improve the status of the engineering profession. What it amounts to, therefore, is that a consulting electrical or mechanical or gas engineer must pass an examination set by the Institution of Civil Engineers before he can become a member of the proposed Association of Consulting Engineers and call himself a "qualified consulting engineer." In view of this limitation, it is difficult to see how the proposed Association can be at all representative of the profession. It has been

argued by the apologists of the promoters of the proposed Association that the term "civil engineer" simply means an engineer who is not in the military service, and that civil engineering is not a specialised form of engineering, but embraces all others. If this be so, it is somewhat strange that the circular issued by the hon. secretary should particularise *civil* engineering as a branch of the profession, on a par with mechanical, electrical, gas and other forms of engineering.

As we have mentioned before, we are in sympathy with any movement which has for its objects the improving of the status of the engineering profession, but we cannot help feeling that there is some justification for the growing suspicion that the present proposal is an attempt to draw a ring-fence round a certain section of the consulting engineering profession—a fence which may or may not have the effect of adversely affecting many qualified consulting engineers who are debarred from membership. There is the possibility that, if this restricting condition be adhered to, the attempts which have been made in other directions to unite the practising consulting engineers into an association may be persevered with, and result in the formation of an association on more comprehensive and representative lines.

Brussels Exhibition, and Turin.

We have already referred to the excellent general catalogue of the British exhibits, compiled by the Exhibitions Branch of the Board of Trade; we have since received a number of departmental catalogues, dealing with the exhibits of mathematical and scientific instruments, mechanical engineering and electricity, and the chemical industries respectively.

The first-named was edited for the Board of Trade by the National Physical Laboratory, under the supervision of Mr. E. H. Rayner, free of cost to the exhibitors, and is a volume of some 230 pages, liberally illustrated, and containing complete descriptions of most of the instruments shown, the whole forming a reference book of permanent value. It is published in both English and French editions. The other two catalogues are not so large, but each is the work of a committee of distinguished specialists, and is not a mere list, but rather a record of scientific and commercial progress, full of interesting matter, and well worthy of its purpose. It is hoped that the publication of works of this nature will induce other firms to avail themselves of the many facilities offered to exhibitors by the new Department of the Board of Trade in connection with the International Exhibition at Turin next year, and subsequent exhibitions.

In our opening article on the Brussels Exhibition, in our issue of July 1st, we recorded some of the impressions that we received during an early visit—rather too early, it would appear, for several of the points upon which we commented unfavourably have since ceased to exist. For instance, boxes have been provided for descriptive pamphlets in connection with the show cases, and a joint representative has been appointed to deal with the exhibits in the Scientific and Chemical Sections, whose services, paid for by subscription, have proved of great value to the exhibitors. In fact, we have ascertained that a harvest of useful orders has already been reaped by some of the British firms represented, and we confidently anticipate that those who exhibited from this country will be amply rewarded for their patriotic and well-advised enterprise. At the offices of the British Commissioner every facility is afforded to inquirers to obtain information, and comfortable accommodation is provided for the representatives of exhibitors. Since the time of our visit other important exhibits have been completed, and we understand that, taken as a whole, the British show will bear comparison with that of any other nation.

We pointed out the effect produced upon the mind by the concentration of the great German display in one imposing mass, and expressed the hope that on future occasions, when the conditions which in this case compelled the division of the British exhibits would no longer obtain, the Exhibitions Branch would endeavour to carry out a similar scheme. We have since received the Memorandum of Information relating to the Turin International Exhibition of 1911 from the Department, and are pleased to observe that this course will be followed. The Memorandum contains full particulars as to the organisation of the British Section, which will occupy a prominent and central position, on a site of 220,000 sq. ft.

Very complete arrangements have been made for the transport of goods to the Exhibition, at reduced charges and free of Customs duty, and the Department is doing everything possible to reduce the cost of exhibiting and to facilitate the installation of exhibits. In view of the success attained even at this early period, and under somewhat adverse conditions, at Brussels, there is every reason to hope that with the advantage of the experience already gained, and the benefit of a more highly developed organisation, the Exhibitions Branch will be enabled to raise the British Section at Turin to a standard of excellence hitherto unapproached, and that the impression of our national decadence, which, thanks to our inertia and lack of enterprise, has been gaining ground abroad, will be finally dispelled.

The British manufacturer has a rooted aversion to what he is inclined to regard as interference with his business on the part of a Governmental Department, and is apt to look askance upon its offers of assistance. When, however, he realises that the new department has been specially created to advance his interests, and, what is far more important, is thoroughly capable of accomplishing its purpose, we have no doubt that he will heartily co-operate with it in the endeavour to restore and maintain the prestige of this country in the spheres of art, industry and commerce.

The "One-wear" Steel-tired Wheel.

This is the characteristically pithy name which our cousins have given to a wheel with a tire just thick enough to last until the present standard tire would want re-turning. It does not appear that any of these one-wear wheels have been made, but the manufacturers have been approached, and it will not be long before some interesting results are recorded. The idea is that the first inch of the tire is the only economical portion. If the standard wheel runs 125,000 miles before the first turning, it will run only 50,000 or so between the first and second turnings, but the cost of getting out the wheels, turning and replacing them will be the same on both occasions. It has been estimated that the additional weight due to the depth of rim left after the first wear costs from 4 cents to 7 cents per lb. per year to carry round; and, apart from questions of economy, it is found difficult on many cars to allow for so much variation in wheel diameter as the standard thick tire presents during its life. Probably this latter consideration will arrest the attention of some British managers, who have experienced much difficulty in changing over from cast-iron to steel-tired wheels on account of the truck clearances being designed for the comparatively small variations in diameter of the cast-iron wheels during their lives.

More will be heard from the Americans on this matter, and it is to be hoped that we shall not leave all the initial experiments and the final development to them.

COAL-CUTTING MACHINERY AND ELECTRICAL ACCIDENTS IN MINES.

(*Continued from page* 234.)

As regards accidents due to electricity, it is very unfortunate that more details are not given. Some of the Inspectors give very full reports, embracing the opinion expressed by H.M. Electrical Inspector of Mines, but it would have provided both interesting and useful information had there been a separate report issued by the Electrical Inspector, giving full details with sketches of the defective apparatus causing the accidents. In other cases there is merely a record of the accident, and no details whatever are given. Two accidents unfortunately resulted in firedamp explosions.

The following table shows the number of fatal and non-fatal accidents as reported to the District Inspectors :—

Summary of Electrical Accidents showing Number of Persons Killed or Injured.

	Underground.		On Surface.	
	Fatal.	Non-Fatal.	Fatal.	Non-Fatal.
No. 1 district ...	—	5	—	—
No. 2 „ ...	6	3	—	1
No. 3 „ ...	—	1	—	1
No. 4 „ ...	2	2	—	3
No. 5 „ ...	2	3	—	3
No. 6 „ ...	—	1	—	1
No. 7 „ ...	1	2	—	—
No. 8 „ ...	4	5	—	2
No. 9 „ ...	—	1	—	1
No. 10 „ ...	—	1	—	2
No. 11 „ ...	3	15	—	1
No. 12 „ ...	—	—	—	2
	—	—	—	—
Totals ...	18	39	...	17

Remarks.

No. 1 district.—One man injured by tub leaving rails and damaging cable. One man injured by short-circuit on coal-cutter new cable. Two men injured by coal-cutter becoming alive, due to plug melting in socket.

No. 2 district.—Three men killed by ignition of firedamp by faulty trailing cable connection. One man killed by handling faulty coil of cable. One man killed by shock from electric lamp or cable. One man killed when leaning over coal-cutter to work controller.

No. 3 district.—No particulars given.

No. 4 district.—Boy killed by shock from lighting cable. Man killed when tightening a nut on back of switchboard. One man injured through damage to trailing cable. One man injured by shock from lighting cable. One man injured, due to faulty coal-cutter controller.

No. 5 district.—Two miners killed by explosion, due to firedamp being ignited by electric spark from faulty switchbox. Particulars of non-fatal accidents not given.

No. 6 district.—Motor man burnt by fingers touching live part of controller. Particulars of surface accident not given.

No. 7 district.—Pump minder killed by coming in contact with bare part of cable.

No. 8 district.—One man killed due to haulage rope becoming alive. Two men killed due to defective earth on coal-cutting machine. Pump attendant killed, due to faulty ammeter. Man received shock through coming in contact with 16-c.p. incandescent lamp terminals. Coal-cutter driver received shock owing to leakage on the machine. Trammer received shock when pulling on haulage rope, due to leakage. Loader slightly burned through touching damaged cable. Driver boy severely injured through inserting his thumb into empty lampholder. Youth injured through his water bottle being attached by a wire to fuse by other boys.

No. 9 district.—Motor driver had his hand slightly burned through throwing in overload cut-out switch. Motor-man was slightly burned through switching on motor against full load.

No. 10 district.—No particulars given.

No. 11 district.—One man killed while connecting two ends of lighting cable, broken by fall of roof. Two men killed by touching cable armouring which had become alive. Electrician injured by short-circuiting of current between dynamo brushes. Pumpman slightly burned by touching signal wire which was in contact with current carrying cable that had been damaged. Particulars of other accidents not given.

No. 12 district.—No particulars given.

Of the four accidents in No. 1 District, causing injury to five persons, Mr. McLaren remarks of three of them :—

"A drawer was proceeding outbye with a loaded tub when it left the rails, and striking the cable, damaged it, and the man is said to have received a slight shock."

"While a coal-cutter attendant was lifting a face cable a short circuit took place, burning the cable and causing a flame, whereby he was burned ; *the cable was new.*"

"Two men, engaged at a coal-cutter, received a shock by the machine becoming live, due to the current *melting plug in socket.*"

The first is a simple accident, but one which might easily be avoided. No information, however, is given as to how the cables were fixed. No doubt they were suspended at about level with the top of the tub. A much better way of fixing cables in a mine on haulage roads is to lay them in a strong wood or earthenware casing on the ground, taking special precautions where it is damp or wet. Had the cables been laid in such a way in this case the accident would not have been possible.

With regard to the other two paragraphs, the italics are ours ; both cases are remarkable, inasmuch as in one by lifting a new cable a short circuit of such severity occurred that the cable was burned ; and in the other the connecting plug melted in its socket. Surely there must have been something very seriously at fault in both cases, and which one would think could have been detected. It is very unfortunate that no details are given as to the causes of these accidents.

Mr. McLaren also reports that two deaths occurred with "bar" coal-cutters. In one case the deceased was caught by the picks in the revolving bar and "terribly injured." It appears that in turning the machine the bar had to revolve at the same time, but in order to obviate this danger an arrangement is now in use for throwing the revolving bar out of gear during this operation. In the other case "the bar had just been 'slewed' into the coal face when a wheel connected with the slewing gear broke and the bar came back and caught deceased." This accident would have been avoided if the slewing gear had been arranged to be worked from the back of the machine away from the bar.

In two cases proceedings were taken against the managers for contravention of the Electricity in Mines Special Rules. In one the agent, district manager, and local manager were proceeded against for having defective electrical plant ; and this was the subject of our leading article on December 31st last. In the other the manager was summoned "for failing to have an electric coal-cutter substantially bushed with insulating bushes" ; but both the cases were dismissed.

In No. 2 District is reported one of the explosions caused by the ignition of firedamp by electricity and which resulted in the loss of three lives. The accident occurred at the Ferniegare No. 1 Pit, Lanarkshire, in the Virtuewell coal, 450 yards from the pit bottom.

The three men were employed working a coal-cutter, and descended the pit about 11 a.m. ; and at 1.30 p.m. after the machine had cut a distance of 43 ft. along the longwall face, it was stopped to allow one of the men to lengthen the trailing cable by means of a plug connection between two lengths of cable, when an explosion of firedamp took place, killing one man instantly and fatally injuring the other two. Safety lamps were in use, and these were afterwards tested and reported to be in good order. The current was continuous and the voltage 420. On examination of the electrical plant, "the trailing cable was found in bad condition, the leather protection being worn away in parts. The method of extending the trailing cable was by means of disconnecting it from the coal-cutter and the insertion of a second length of cable, the joining of the two lengths being made with an ordinary plug connection without any arrangement whatever to guard against the circuit being accidentally broken. The gate end box was not gas-tight, and both the design of the box and the method of, and the arrangements for, lengthening the trailing cable were unsuitable for a safety lamp pit. The fuses were still in the gate end box showing that the length of cable connected to the gate end box was alive at the time the workman was connecting the two lengths of trailing cable. As the explosion appears to have happened when the cable was being lengthened, likely the firedamp, which apparently had accumulated in the workings, became ignited by a spark made in joining the two lengths of trailing cable. There was no evidence forthcoming upon which to base any other theory."

In consequence of this the colliery manager was "charged with contravening Electrical Special Rule 30, in respect that

he failed to see that the trailing cable was kept in order, but it was decided that it was inadvisable to proceed in respect of the inefficient and in the circumstances dangerous method of joining together the two lengths of trailing cable (Electrical Special Rule 33), because the electric plant had been put in before the rules governing the use of electricity in mines had been established." This, however, is no excuse, except that of excusing inspection, for Special Rule 55 distinctly states that "any electrical plant or apparatus . . . in use before the coming into force of these rules may be continued in use *unless an inspector shall otherwise direct, or subject to any conditions affecting safety that he may prescribe.* Consequently, "inspection" was quite as much at fault as the colliery manager.

"With regard to the trailing cable, the sheriff found that though it was probable that it had been defective before the beginning of the shift during which the accident occurred, *the man who was in charge was the person responsible under the Electrical Special Rules*"; therefore the sheriff found there was no evidence of neglect on the part of the manager, and the charge was declared not proven.

This is an example which shows clearly how extremely careful one ought to be in giving attention to minute details in connection with electrical apparatus. The method of connecting the trailing cable can only be described as a makeshift; but so long as it answered its purpose no one ever thought anything about it. It is strange that no one has ever thought of making connections of the trailing cable to both the machine and the gate end junction box, as well as the cable itself, by means of screwed unions, in the same way as flexible air pipes are put together. Such a joint could be designed so that there would be no actual contact until the union of the coupling had commenced to screw up; and another advantage would be that very much better contact could thus be obtained than by merely pressing a plug into a socket.

At Auchengeich Colliery a man was killed by handling a coil of wire, the insulation of which was subsequently found to be completely worn away in two or three places. The system of distribution was three-phase, 440 volts, 50 cycles, the neutral point of the generator being earthed. The coil handled by deceased was used for lighting purposes; the lamp being connected between one of the three phases and the cable armouring which was connected to earth. The supply thus obtained would be 250 volts, which would be the shock received by the deceased. "Mr. Nelson (H.M. electrical inspector) pointed out a serious objection to the system of lighting at Auchengeich through liability to electrolysis trouble on account of the current used for lighting returning to the generator *viâ* the cable armouring, through intervening joint-boxes, &c., and recommended the use of transformers of suitable design, for transforming down to not more than 100 volts." The owners would be wise if they adopted 50 volts in preference to 100, and used low volt metallic-filament lamps.

At Dechmont Colliery a somewhat similar accident occurred. In this case the supply was given by the Clyde Valley Electric Power Co., as three-phase 25-cycle current transformed down to 400 volts. The neutral point of the secondary winding of the transformer was connected to earth. For reducing the pressure to 100 volts the current was passed through an auto-transformer, but as one of the phases proved to be carried straight through the transformer, Mr. Nelson calculated that the deceased received a shock of the full voltage of each phase to earth, namely, 230 volts, which proved to be almost immediately fatal.

In both these cases there is surely carelessness almost amounting to criminal neglect on the part of someone. The managers are scarcely to blame as it is impossible for them to have the technical knowledge necessary to supervise the installation of electrical plant. But it would be interesting to know who the contractors were, and the terms of the contract?

A coal-cutter driver was killed at Polmaise Colliery through receiving a shock when working the controller of the machine. "The electricity at this colliery is generated as three-phase current at 500 volts. The primary cause of the accident was found to be a defect in the auto-starter of the coal-cutter motor, *which had previously been found to be defective, and afterwards ineffectively repaired*; the secondary cause was an inefficient earth connection for the frame of the machine."

The real cause of this accident was that no one was employed at the colliery who was sufficiently capable of doing the repairs, and it might reasonably be asked, who was the *competent* person in charge of the plant, and what was his training? Evidently this poor man's life was sacrificed for the sake of questionable economy! It is further suggested that had the machine frame been efficiently earthed, the ineffective repairing of the controller would not have mattered. It appears to be assumed that there is no difficulty in securing an "efficient earth" in a mine, which is very questionable; but apart from this it is surely much more sensible to advise managers to employ someone who is fully capable of keeping the plant in efficient repair, than to "emphasise the importance of providing efficient earth connections for all electric coal-cutting machines, and . . . . urge mine owners and managers to give this recommendation serious consideration with a view of minimising the risk of shock."

In No. 4 District a driver boy was electrocuted at the Lambton Collieries' North Biddick Pit, by a shock received from a lighting cable. It appears that the cable was carried in thin tubing, and the lamp hung on the end of the cable suspended over the end of the tube. By constant rubbing the insulation had become worn off. Again it may be asked, who was responsible for such disgraceful shoddy work?

In the second case, which occurred at Shildon Lodge Colliery, the pump attendant noticed that a nut fixing the cable lug to its terminal was loose, and went behind the switchboard and attempted to tighten it up whilst the current was on. This appears to be a pure accident, due to over-zealousness on the part of the deceased; for, in the first place, he should and could have had the current shut off, and in the second, he had no business to interfere.

Of the three non-fatal accidents, one was due to the neglect of a coal-cutter driver in allowing his machine to run over and damage the trailing cable. He received a slight shock, and was afterwards hauled before the magistrates, who ordered him to pay the costs of the proceedings. It seems hard to prosecute a man after he has been injured, but the manager in this case did the right thing, as the man was not only paving the way for an accident to himself, but to his companions.

In the second accident, two shaftmen were working with a 16-C.P. lamp on the end of a flexible, the other end of the flexible being fitted with a lampholder connecting plug. Another lamp had been taken out of its holder and the flexible plug fitted into its place. When they had finished work, one of them went to disconnect the flexible and replace the lamp, when he received a shock and accidentally pulled down some of the cable on top of himself. On examining the piece of flexible it was found to be defective and *its armouring had become alive.* Fortunately, some ambulance men applied artificial respiration and saved the man's life. This accident would, in all probability, have been entirely avoided had the cable *not been armoured.*

In the third case, the controller of a haulage motor occasioned a fire which might easily have had serious results. The cause of the fire was the continued heavy arcing which took place under oil in the controller, due to the *contacts being too small* for the current they had to carry. Evidently someone has been very much at fault, and it would be interesting to know if it were the colliery manager or the contractor?

(To be continued.)

Crewe Lighting.—Important extensions of the lighting mains are pending. The T.C. proposes, subject to one-half of the cost of the cable (£500) being contributed, to extend the mains to supply 40 villa residences to be erected by Messrs. Clews, Brown & Co., at Wistaston. A cable is also to be laid, at a cost of £275, to supply current to the new postal sorting office. About 360 lights will be required at the new training college, and the cost of the extension there is placed at £500. Lord Crewe's agent is to be interviewed respecting the development of the land adjoining the site of the training college, and the probable requirement of a supply of electricity.

THE ELECTRICAL WORK AT THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT, CHARLOTTENBURG, IN 1909.

By E. S. HODGSON.

The following notes* describe the more important electrical researches carried out at the above Institution last year, and readers are referred to the annual report of the Reichsanstalt for fuller details.

Silver Voltameter.—Experiments were carried out on the silver voltameter with the object of ascertaining whether organic substances would have any influence on the silver deposit. One set of experiments was made with the anode enveloped in raw silk; another without this silk. It might thus be supposed that small differences between the two series of experiments would be traceable to the employment of an organic substance (silk) in the first case. The relative measurements, however, appear to show that this is not the case. The mean difference in the experiments with and without silk was about one part in 200,000, the mean error of an observation being approximately 6 in 100,000.

Standard Cells.—Some experiments on mercurous sulphate showed that samples which in general resulted in cells having a normal E.M.F. would cause variations in E.M.F. if kept in a dry state for some months. The cells prepared in the latter condition have an E.M.F. a few parts in 10,000 too high. A further conclusion arrived at was that no alterations take place in the behaviour of the mercurous sulphate if the freshly prepared salt is kept under a solution of cadmium sulphate, or *in vacuo*. This suggests a chemical action of the oxygen of the atmosphere on the dry salt. It is believed that with the discovery of this phenomenon, the last disturbing factor in the behaviour of the mercurous sulphate in standard cells has been found.

Influence of Mercury Vapours on Ampere-Hour Meters.—In recent years D.C. ampere-hour meters have been submitted to the Reichsanstalt for systematic testing in which the armature (shunted across a resistance traversed by the supply current) rotates in the field of a permanent magnet. Such meters have often failed to satisfy the demand for constancy of the readings when on load for a great length of time; rather have irregularities been apparent in them, or a sluggishness of action increasing with time. This phenomenon, according to the Reichsanstalt, would appear to be caused by small variations of the contact-resistance between armature and brushes. J. Busch (*Ztschr. für Elektrochemie*, 1909, page 180) has endeavoured to show that mercury vapours are in a great measure responsible for these disturbing conditions, but according to experiments made at the Reichsanstalt, the results obtained by Busch must be ascribed to other influences.

Experiments on the "Ageing" of Fuses.—It frequently happens in practice that fuses undergo a considerable increase in resistance after being in use over an extended period. The Reichsanstalt has made a number of experiments upon this phenomenon at the request of the German Society of Electrical Engineers. Three causes are advanced for the so-called "ageing": (1) change of the fuse wires by overloading; (2) pulverisation of the metal under high pressures (voltages); (3) influence of the filling material. Experiments were first made with silver wires stretched in the open, the wires being 0·5, 0·25 and 0·1 mm. thick. A light load was sometimes applied, the wires at other times being rendered slightly incandescent with the current. At the outset all wires showed a decrease of a few parts per cent. in resistance, this result being traceable to the fact that the wires, made hard by drawing, are softened by being heated by the current. The 0·5 and 0·25 mm. wires showed no noteworthy change in resistance either when the load applied was trifling or when it was considerable; the same can be said of the 0·1 mm. wire, loaded with a weak current. On the other hand, the 0·1 mm. wire when loaded with two amperes suffered a permanent increase (20 per cent.) in resistance, eventually fusing after 12 weeks. The metal appeared to be not simply oxidised, but also to have undergone extensive structural changes. The behaviour of the test wires was independent of the manner of soldering. At present experiments are being repeated on the 0·1 mm. wire with lower currents. No results are yet available as to pulverisation on high voltages, or as to the influence of the inner material of the fuses.

Photometry.—An increasing number of life tests were made on carbon-filament lamps, the majority of these tests being made on A.C.

A 1,500-hour life test was made on 16-C.P. metal-filament lamps having an initial power consumption of 1·1 watt per Hefner candle measured perpendicular to the lamp-axis; the pressure was constant, being 113 volts, and half the lamps were tested on A.C. and half on D.C. This is mentioned, as it is only lately that this type of lamp has been manufactured of low candle-power and high voltage.

Two other series are also worthy of notice, in which the lamps were tested on D.C. until the candle-power dropped by 20 per cent. of the initial value. In the first series of 110-volt lamps, the life of nine averaged 3,210 hours before dropping by the prescribed percentage, while the tenth lamp did not show this drop on the conclusion of the test after 3,700 hours. The second series comprised 20 220-volt lamps. Seventeen of these burnt out after an average life of 3,650 hours; in the case of the other three the test was concluded at 4,000, 5,500 and 6,000 hours respectively owing to the 20 per cent. drop in candle-power.

Most of the glow lamps *not* tested for life were intended to be used as photometric standards. It may be mentioned that the use of metal-filament lamps for this purpose was considerably on the increase during the past year. Lamps with the filament in one plane are recommended by the Reichsanstalt as standard lamps for candle-powers to be taken in a definite direction.

The Reichsanstalt has collaborated in the work of drawing up conditions for the testing of lamps under the German Illuminants Taxation Act which came into force in 1909, and according to which glow lamps are taxed on the watt consumption. Sample lamps, selected from batches, are to be tested to see that the candle-power which the manufacturer has marked on his lamps is correct. This work of testing will probably be placed entirely in the hands of the Reichsanstalt, for a certain time at any rate.

A number of other researches might be mentioned, but these are not of much interest to the electrical engineer.

*From the *Tätigkeitsbericht der Physikalisch Technischen Reichsanstalt im Jahre* 1909.

ECONOMY IN FUEL FOR PROVIDING ELECTRICAL POWER FOR MANUFACTURING PLANTS.

The substitution of electric motors for the older method of steam engine driving in manufactories does not constitute the last word in the direction of economy, by any means, although it forms a very important step in reducing the quantity of fuel consumed and mechanical losses for a given output. The losses due to condensation of steam in pipes, as well as very considerable stand-by losses, where scattered small units of steam power were in vogue, are greatly reduced, besides being accompanied by many other economies.

Leaving the electrical engineer to deal with the advantages of electric driving over the older methods, it is sufficient here to point out that *economy* is the chief object in view, and when laying down any new manufactory or remodelling an old plant, the question of economy should be thoroughly considered through every stage from the fuel delivered to the power and heat turned to profitable use.

Only a partial benefit is obtained when the electrical generator and motors are applied without also taking steps to provide, on the one hand, that the fuel consumed in generating the electric current is employed in the most efficient manner, and on the other hand, that the energy generated is not wasted.

In this connection, Mr. Percival Robert Moses has given some instructive figures in the *Engineering Magazine* of

December, 1909, in an article on "Gas Engine and Producer Installations for Manufacturing Plants," comparing gas power, oil power and steam power costs.

Assuming a manufactory where all the machinery is electrically driven, the character of the work being that of a foundry or machine shop, where the loads are heavy and fluctuating, he bases his figures on a plant operating 10 hours a day through the year, with a yearly output of 1,000,000 KW.-hours with a maximum load of 400 KW., and average load of 300 KW.

The comparative costs of the different types of plant, not including the power house, are estimated as :—

Steam installation, compound, condensing, per KW. ...	£20·83
Gas power „ per KW.	23·95
Oil „ „	27·50

and the total costs, not including, with the steam plant superheaters or economisers :—

Gas engine installation	£14,583
Oil „ „	16,250
Steam „ „	12,500

The annual costs of these three different installations are worked out as :—

Gas Engine and Producer Plant.		*Oil Engine Plant.*		*Steam Engine Plant.*	
Fuel — Coal at 10·42s. per ton ...	£521·0	Oil at 1·44d. per gal. ...	£895·8	Coal at 8s. 4d. per ton ...	£1,250
Labour ...	521·0	Labour ...	375·0	Labour ...	556
Oil for lubrication ...	83·3	Oil for lubrication ...	125·0	Oil for lubrication	63
Repairs ...	156·0	Repairs ...	187·5	Repairs ...	208
	£1,281·3		£1,583·3		£2,077
Fixed charges 10 per cent.	1,458·3	Fixed charges 10 per cent.	1,625·0	Fixed charges 10 per cent.	1,250
	£2,739·6		£3,208·3		£3,327
Cost per KW.	0·631d.	Cost per KW.	0·739d.	Cost per KW.	0·763d.

Thus, it will be seen that the oil installation compares favourably with the steam plant, while the gas-driven set has an advantage of nearly 18 per cent.

To compare the figures given by Mr. P. R. Moses for the cost of gas power with those given by Messrs. Leonard Andrews and Reginald Porter, in their very carefully prepared paper on "The Use of Large Gas Engines for Generating Electric Power,"* the cost per ton of coal has been taken as the same in both cases, and the results given in percentage work out as follows :—

GAS-PRODUCER INSTALLATIONS.

Annual capacity ...	1,000,000 KW.	21,000,000 KW.
Authority ...	Mr. P. R. Moses.	Messrs. Andrews & Porter.
Coal at 10·42s. per ton	19·0 %	32·8 %
Labour	19·0 %	10·6 %
Oil	3·0 %	4·5 %
Repairs	5·7 %	10·0 %
Fixed charges ...	53·3 %	42·1 %
	100·0 %	100·0 %

It will be noticed that the cost of fuel in the smaller installation is 19 per cent., while in Messrs. Andrews and Porter's amended figures it is given as 32·8 per cent.; the figures quoted for the steam power installation give, however, 39 per cent. of the total works cost, and in regard to the question of the highest possible economy the cost of fuel constitutes the main item to be attacked in the figures given. In the figures of cost which we have been discussing these refer to the units of electrical energy generated, as measured at the switchboard; but, of course, the actual cost and efficiency should be reckoned upon the units sold or turned to effective account. In an electrical power station, where the current is applied in such a manner as to be accurately measured for stated prices, as in lighting and power central stations, the conditions differ greatly from those of the manufactory where the power is applied in various combinations, because there then exists the possibility of considerable waste of power. Motors may be employed for pumping water for hydraulic presses, or compressing air for pneumatic tools, so that the equivalent of the cost of units sold in lighting stations has to be obtained in work performed by the different classes of machinery applied. Much energy can be wasted by the improper use of hydraulic tools; while in the pneumatic combination there is not only a low efficiency, but there are many possibilities for waste of energy, such as leaky connections, &c.

It is not always fully understood by the users of presses and tools that each stroke of the press, or employment of machinery worked by electric current, means an expenditure of energy, and therefore cost, the idea sometimes being held that as the electric generators are always at work it makes no difference whether the machinery or tools are applied to useful work or not, in regard to the cost of the power. Mr. P. R. Moses illustrates his article by a number of large power gas engines and producer plants.

*Paper read before the Institution of Electrical Engineers, 1909. See ELECTRICAL REVIEW, February 19th and 26th, 1909.

PRIVATE BILL LEGISLATION OF THE PAST SESSION.

[BY OUR PARLIAMENTARY REPORTER.]

IF the condition of the electrical industry of this country is to be judged by the number of Private Bills promoted in the past session of Parliament, and particularly by their importance, then it is indeed in a parlous state. Fortunately, such a criterion would not be a true one, because the period of feverish activity of some years ago was bound to be followed by a period of comparative stagnation. Practically all the municipalities have settled their tramway and electric light proposals; most of the country has been parcelled out amongst the electric power concerns, whilst the investor has not reaped such a golden harvest from tube railways, so far, as to be tempted to find money for further schemes, although it must be noted that most of these railways are now making steady progress, and the application of electricity to railways generally will certainly receive a great impetus from the success attained by the London and Brighton Co. In view of these conditions, the number of Bills promoted was bound to decrease; but at the same time there is no escaping the fact that promoters have of late fought shy of new electrical projects. In other words, there have been no "novelties"—no schemes for monorailways, for combined motor roads and tramways, for pneumatic tubes, &c. Both electrical companies and municipal bodies have been content to mark time, and the result is reflected in the committee rooms of Parliament.

Perhaps the most interesting Bills from the electrical point of view were those of the Leeds and Bradford Corporations for the running of tramways on the railless trolley system, which has now been allowed for the first time in this country, and if carried into effect will doubtless be watched with the keenest interest by tramway engineers. Another tramway Bill which was the subject of very considerable interest from a different point of view was the proposal of the Devonport and District Tramways Co. to override the agreement with the Corporation of Devonport with respect to the provisions of the lease. Some extraordinary statements were made as to the manner in which, it was alleged, the company were induced to take up the lease, but the Committee threw out the Bill. The London County Council as usual brought up proposals for electrifying and constructing further lines, and although some were withdrawn owing to the opposition of the local road authorities, yet in the end tramways and street widenings involving an expenditure of about £1,000,000 were agreed to. The Rhondda Urban District Council Tramway Bill brought up the usual opposition from the Taff Vale Railway Co., and although the Bill was passed it did seem that in this particular case the railway authorities had some reason for feeling aggrieved, as they have spent a large sum of money in improving the travelling facilities in the Rhondda Valley. The London United Tramways Co. got a useful

little measure through for working a short piece of line near Richmond on the overhead system, notwithstanding the opposition of the Middlesex County Council, who wished to have the right to decide what system of traction should be used. The Morecambe Tramways Bill allows mechanical traction to be used on certain lines which have been sold to the Corporation by the Tramways Co., and the company will now be wound up. The Handsworth Urban District Council obtained powers to construct a number of new tramways, but in view of the confirmation of the provisional order to enlarge Birmingham, the presumption is that these tramways will become part of the undertaking of the City Corporation. The only other tramway Bill was that of the Cavehill and Whitewell Tramway Co. to give the company and the Belfast Corporation mutual running powers, but this was not proceeded with. One Tramways Provisional Order Confirmation Bill was brought in by the Board of Trade which gave powers for further tramway construction to the Corporations of Huddersfield and Rawtenstall, and the Milnrow U.D.C.

Of the railway Bills, in one sense the London Electric Railways Amalgamation was the most important, although there was practically no opposition. It was purely a finance measure, and amalgamates the Piccadilly, the Bakerloo and the Hampstead Tube Companies with a capital of £16,800,000 as against a present capital of the three companies of £15,920,000. Some portion of the new capital will be used for constructive purposes. The Mersey Railway Co., which has shown great improvement in traffic since the electrification of the line, also promoted a Bill of a financial nature dealing with the payment of interest to the debenture holders. As this was done with the consent of the debenture holders the Bill had no opposition. The North and South Shields Electric Railway Bill, after going through several stages, was withdrawn. This project was first authorised in 1902 to make a railway under the Tyne, and the Bill was for an extension of time. The North-East London Railway Bill was also an application for extension of time for the construction of a tube railway from the City to Waltham Abbey, but it was dropped early in the session. The only new electrical railway project was that of the Wimbledon and Sutton Railway, which incorporates a company with a capital of £350,000. Despite great opposition from the London and Brighton Railway Co., the Bill was approved. The Baker Street and Waterloo Railway Co. were successful with their Bill, which gives them power to construct a subway at Oxford Circus and to make a moving staircase. The Metropolitan Railway Co. and Metropolitan District Railway Co. were both successful with Bills for improving their systems, but the Charing Cross, Euston and Hampstead Railway Co. dropped their Bill for extension to the Embankment, owing to the onerous conditions imposed on them by the Committee. The Great Northern and City Railway Co. dropped their Bill for extending to Moorgate Street quite early in the session.

Only one electric power Bill was promoted, viz., that of the Yorkshire Co., who obtained powers to facilitate the raising of further capital. The Reading and District Electric Supply Co. got powers to extend their area, and the London Electric Supply Bill was passed, which makes the London County Council the purchasing authority in regard to the whole of the electric lighting companies operating in the county area. Several gas companies obtained powers to supply electrical energy, viz., those of Bishops Stortford, Harlow and Epping, Chipping Norton, Farnham, and Havant.

Amongst the omnibus Bills promoted by Corporations were those of the Nottingham and Southampton Corporations, each of whom obtained further powers for the construction of tramways. Considerable discussion took place over the London County Council General Powers Bill, which proposed stringent alterations in the existing law to deal with the smoke nuisance. These clauses were opposed by the London electric lighting companies, and, as a result, were very materially modified. Three electric lighting provisional orders were promoted by the Board of Trade, and were carried, also confirming orders in respect of Navan, Chesham, Church, Cleveland, Dawlish, Derby, Gorseinon, Huddersfield, Ormskirk, Runcorn, Smethwick, Widnes, Ardrossan, Cambuslang, Cowdenbeath and Skelmorlie.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Overcrowding in the Ranks of Central Station Engineers.

I think this subject would do with some serious investigation, as, in my opinion, it is of vital importance to the prosperity of the electrical industry, central stations, and the engineers employed therein. For the past few years there seems to have been an attraction in electrical engineering which has drawn a lot more workers than it can possibly support. In every issue of the journal there have been "vacancies for pupils" with and without premiums, and I do not think I shall be far wrong in saying that every central station in England has taken in one pupil per year. These pupils spend a year with no salary, or very little remuneration, and are then electrical and mechanical engineers. From my personal observation, that year seems to be a time of loafing; they come and go when they like, and their theoretical knowledge is on a par with their practice. Their assurance is at the other end of the scale.

At the end of their apprenticeship few chiefs turn these "engineers" away, and after a short while they are put on wage, which means, as the staff was complete before, that there is now one more wage per station all over the country for which there is absolutely no need. There is not one person per station per year who leaves the profession by either dying, retiring or going into something else.

As a rule, these pupils are the sons of well-to-do people of the town in which they serve their apprenticeship, who either have a lot of influence with the Council or are big creditors of the Corporation. At any rate, the pupil is at home, and at home he stays, gradually working his way up, or I should say getting a better position year by year, and, perhaps, finally becoming chief—a man who has never been in any other station in his life. In the course of time that station grows and needs new plant, &c., and the engineer advises his Committee what they shall do.

What is his knowledge to advise upon? He has none; therefore, the ratepayers of that town give him his experience, and they pay for it, oftener than not, rather heavily. As to advising consumers as to electrical driving, what does he know about drives? The result is that the consumer always has trouble, and probably throws his motors out and goes back to steam.

Now, as to altering this state of things, I think that station engineers should not be allowed to take premium apprentices; in fact, I do not think a central station is a place for apprentices at all. I consider the lowest official should already have a good varied experience and theoretical training outside the station. Also I think that the B. of T. should examine and issue certificates, and that positions should be given on these certificates. If these lines were followed, I think all the trash would be cut out and the electrical industry would be the gainer, as well as the ratepayer.

D. E.

Commutator Troubles.

A′ C′ A C, in my diagram, does not represent an "E.M.F. and time" charging curve. Since, for clearness, the effect of "cutting out" a couple of stops is considered at the commencement of the charge, with the battery, in both cases, in a similarly discharged condition, the above-mentioned curve need not be taken, materially, into account.

The initial charging voltage assumed, serves as a basis for the comparison of A B, C D and A′ B′, C′ D′ consequent on identical increases of field current, at the two speeds under consideration; the slight variation of charging voltage, due to a variation of the charging current during these operations, being considered, for the purpose of comparing these relative measurements, negligible in amount.

W. T. Hilder.

Electricity and Tramways Department,
Swindon, *August 6th*, 1910.

Lightning Conductors.

Your logic appears to me somewhat peculiar since, while admitting that the most abrupt bends possible (that is, a zig-zag) reduce self-induction and consequent side-flash, you contend that any departure whatever from the straight line between two points increases the self-induction of the conductor joining them, and therefore increases the tendency to side-flash. "The deliberate introduction of superfluous bends" may be left out of account since no expert would, in practice, introduce bends that were not, for one reason or other, necessary. If he did, it would not alter the question for Nature would make no distinction between a necessary and an unnecessary bend.

If I am to understand that you mean a zig-zag would have less inductance than the wire forming it stretched in a straight line, but that it would have more than the short straight wire that would cover the same distance, I beg to say that this is the statement that has been put forward at times for 10 years past, during which time some very extraordinary views about protection from lightning have been in evidence.

This is just the opinion that I challenge, because I believe it unwarranted. I may be wrong; if so, I would rather be corrected than remain in error. But the statement in itself, no matter how often reiterated, is no proof of its correctness, and I challenge you to quote a reliable authority, and to say to what extent side-flash would be increased in a lightning conductor by such bends as are necessary sometimes to prevent a building being disfigured, or for other reasons. If it is merely a matter of infinitesimal increase, it is not worth consideration from a practical point of view.

The matter is one about which there is little published information of a satisfactory character. *Apropos* of the prevalent idea about bends, Mr. N. H. Hopkins, A.Am.I.E.E., described experiments (I believe on behalf of the U.S. Navy Department) he had carried out with a model chimney shaft fitted with a conductor having a gap that could be bridged by various forms of abrupt bends, and found that in five types employed, having 4, 8, 24, 14 and 9 bends respectively, necessitating considerable additions to the length of conductor, the discharges passed readily round the bends; but when anything in the nature of a spiral was introduced high impedance of course resulted. He does not appear to have taken actual quantitative measurements for comparison, so this is not conclusive.

An experiment described by Sir Oliver Lodge is more instructive. He had two leads of copper wire, each 2 ft. long, coupled and found the side-flash to be ·21 in. Then he tried a zig-zag consisting of 21 ft. of tinfoil 3 in. wide, and found the side-flash reduced to ·06 in. Using the two copper leads and zig-zag in one circuit the side-flash was found to be ·23 in. From this we see that the addition of 21 ft. of conductor, reduced by zig-zagging to cover a distance not stated, but causing in itself a side-flash of ·06 in., increased the total side-flash length by ·02 in. only, or not more than the same length (point to point) of straight wire would probably have done. The zig-zag could have been compressed to even less than one-fiftieth part of the whole circuit, but the impression I have from seeing this zig-zag used in an experiment at the Institute in 1889, is that its length was somewhere between 9 in. and 18 in. My memory may be at fault, but it is obvious that it could not have been much less or it could not have been used by itself as a circuit. This does not show any increase of side-flash length due to the bends.

I do not consider, however, that this method of experimenting shows true side-flash conditions. My own experiments have been carried out in a manner that approximates better to actual occurrences with lightning and lightning conductors, and I have found that using a copper wire about 39 ft. long, zig-zagged to occupy a point-to-point space of 10½ in., in comparison with a 10½-in. length of straight wire of the same diameter, the result has been distinctly in favour of the zig-zag.

My explanation is as follows: I presume Sir Oliver Lodge was referring to a straight conductor when he wrote, "the total impedance is commonly to be reckoned in hundreds, or even thousands, of ohms," being half the critical resistance which determines whether the discharge shall be oscillatory or not under the same circumstances.

In a conductor consisting of a straight wire and a parallel return wire there will be little or no self-induction. (S. P. Thompson.) Therefore, though a length of 2 ft. of straight conductor would have more inductance than 1 ft., the inductance-reducing effect of the parallel lines would rather more than compensate for the extra length.

As Sir Oliver Lodge implies, it must not be thought from this that it would be advisable to zig-zag a conductor woof fashion, down the face of a building, but I have known a careful student of his book to specify this. There are sufficient reasons, of a different character, that would render such a course most objectionable.

Among the remarks Sir Oliver Lodge has put forward "more by way of suggestion and question than anything else," about which he has "not the slightest wish to be dogmatic," but which are "well worthy of discussion," is the following:—"Sharp bends and corners, and curves, and roundabout paths to earth should be avoided as far as possible." Though reasons are not given in support of this recommendation, no exception can be taken to it, but the words "as far as possible," lead one to infer that they are not of the vital importance that some electricians have apparently attached to them.

The Lightning Rod Conference (1881) said, "In no case should the length of the rod between two points be more than half as long again as the straight line joining them." In a brochure, published in 1902, I said it should not be more than twice the distance between the two nearest parts of the conductor in a straight line, which I consider still well within the margin of safety. So far, there is not much difference of opinion, but the idea that bends in a conductor would cause the discharge to side-flash off to something else is a different matter. It appears, however, to be very largely held, and I have even known an electrical engineer, over anxious to avoid bends that would have done no harm, make a conductor seriously inefficient in other respects. I therefore think it is high time the idea should either be proved to be warranted or that it should be admitted to be a fallacy, and attention directed only to questions that really do matter.

Alfred Hands.

London, E.C., *August 8th*, 1910.

[There is nothing wrong with our logic. Our position is correctly stated in the second paragraph of our correspondent's letter. As for the effect of bends on the tendency to side-flash, we very much doubt whether laboratory experiments, necessarily conducted on a comparatively minute scale, can throw much light on the actual behaviour of lightning. We agree with Mr. Hands that the harmful effect of bends ought not to be exaggerated.—Eds. E.R.]

Steam Regenerative Accumulators.

In your issue of July 29th, Mr. L. Melville Clark refers to the judgment of the Solicitor-General in connection with the opposition of La Société d'Exploitation des Appareils Rateau to the sealing of my patent:—"Improvements in or relating to water heating apparatus for steam plant and suitable for use in connection with the utilisation of intermittent or irregular supplies of exhaust steam," No. 22,025, 1907.

The point of public interest seems to be that La Société Rateau contended that Prof. Rateau's patent, "Improvements in and relating to steam regenerative accumulators," No. 25,424, 1901, was a master patent, and they therefore sought to compel me to refer to the said patent in my above-mentioned specification No. 22,025, 1907.

The Chief Examiner of Patents decided that the said Rateau patent is not a master patent, and on appeal the Solicitor-General confirmed his decision, so that the desired reference will not be made by me.

Another point of general interest arising out of this case is that the grant of a patent may be opposed on very speculative grounds, and the sealing delayed for a very considerable period, with the result that the public during that period might be deprived of a patent of possibly great commercial utility.

D. B. Morison.

Hartlepool, *August 3rd*, 1910.

The Calculation of Illumination.

I take this, the earliest opportunity I have had, of replying further to "M. F. H. W." With regard to the criticism of the integral on page 960, the area represented by the expression—

$$A = \frac{K\,r}{d\,(r^2 + d^2)^{\frac{1}{2}}},$$

is, of course, the area under the illumination curve (see figs. 2 and 3), and *not* an actual area on the ground. So far as I can see, there is not the least ambiguity in the article concerning this expression. This criticism merely supports my previous remarks.

With regard to Rule (4), page 960, the words "square root of" should certainly be omitted; whether their insertion is due to a slip on my part or the printer's I am unable to say.

Again, on line 12, column 2, page 960, $\sec^2 d$ should be $\sec^2 a$; and on line 13, $\tan^{-1} p/d$ should be $\tan^{-1} r/d$. These two misprints could mislead no one, and will, no doubt, be excused by all those conversant with the difficulty of printing mathematical matter.

C. T.

Kent.

[The three errors in question occur in the original type-written copy. Without working through the argument in detail, it is impossible to detect slips of this kind, and, unfortunately, time does not permit of such careful checking on our part.—Eds. E.R.]

Having it Both Ways.

I see from the Electrical Review of August 5th, that the Lancaster Town Council has granted to Mr. W. A. Tester, their borough electrical engineer, permission to temporarily vacate his present position in order that he may proceed to South Africa for 12 months to a temporary appointment in Johannesburg, providing that an efficient engineer can be obtained to act in his absence.

Whenever I have obtained fresh appointments I have always had to "abide by my decision," but if the action of the Lancaster Town Council creates a precedent, I need have no fear in the future, and we may expect to see in "Our Personal Column" of the Review announcements to the effect that Mr. So-and-So, after 12 months' service in a new job, has decided to return to his old one, as he finds that he does not like the change.

I, personally, would like to have a trial 12 months as borough electrical engineer of Lancaster, but am not quite sure whether my Council would give me permission to come back when Mr. Tester returns from Johannesburg in 1911.

I should be interested to hear what my fellow engineers think of this matter, as I, speaking as one who has had a fair taste of the keenness of competition for positions, consider that if many are allowed to monopolise two jobs, competition will be a jolly sight keener.

Born Unlucky.

August 6th, 1910.

Contracting Manufacturers.

I was very pleased to see Mr. Tomlinson's letter protesting against a certain firm of cable manufacturers competing with electrical wiring contractors. I have been expecting for some time past to see some protest in your columns from one of my fellow contractors, but it has been left to a consulting engineer to do battle on behalf of those who believe in the principle of live and let live.

Curiously enough, five minutes after reading Mr. Tomlinson's letter, I took up the current number of the *Electrical Contractor*, and out of two wiring tenders reported, one was secured by a member of the C.M.A., presumably the firm in question, but not a word of protest could I discover in our official journal.

Is it possible that the members of the C.M.A., having bought the contractors' business by a sort of glorified annual Christmas box, feel they are free to compete with them, without fear of protest or loss of business?

Unfortunately, the cable manufacturers are not the only sinners, for I have in my mind a certain large supply house—a branch of a German organisation—which has, of late, been very active in competing with its customers.

We poor contractors, having been crushed by the upper millstone of rate-aided municipal competition, are now likely to be ground by the nether millstone of the manufacturer-contractor.

While, however, the former competition can only be met by combination, and expensive litigation, each contractor has his remedy against the manufacturer-contractor. Mr. Tomlinson suggests the use of the big stick—I simply closed my accounts.

Contractor.

The Proposed Association of Consulting Engineers.

May I venture to disagree with your correspondent, "M.Inst.C.E., M.I.E.E.," in regard to his statement that "civil engineering comprises every branch of engineering, except military engineering?" Perhaps it did when the term was first introduced; but the meaning of a word changes in course of time, either by widening the scope of its application or, as in this case, by restricting it, and our great railway companies, to quote only one instance, are under no doubt as to what is included in and what is outside the department of civil engineering.

As a further illustration of the way the meaning of a word alters in course of time, I would ask "M.Inst.C.E., M.I.E.E." (would he were less cumbrously anonymous!) whether it can be alleged that a civil engineer is always a *civil* engineer!

Your correspondent refers to the admirably comprehensive character of the Charter of the Institution of Civil Engineers, but the only way to bring the title into line with the Charter is to alter it (as did the Society of Telegraph Engineers in earlier days), and omit the word "civil."

I believe there are a large number of engineers besides myself who would welcome an Institution of Engineers to take the lead in all branches of the profession, but at present none such exists—in title, at any rate.

Harold W. Couzens.

London, S.W., *August 9th*, 1910.

Metallic Filaments for Incandescent Lamps.—A patent was granted July 12th to Dr. W. D. Coolidge, of Schenectady, on an application filed August 1st, 1906, on a process for making metallic filaments for incandescent lamps. According to the invention, a refractory material is incorporated in a colloidal solution to produce a pasty mass, and this mass is squirted or otherwise shaped to form threads, filaments, rods, or other desired shapes; these bodies are then treated to remove all easily vaporisable components and yield a conductor of refractory material suitable for use in incandescent lamps and other apparatus. If silver colloid is used as the binding means and tungsten as the refractory element, it is preferable to have the tungsten in a finely divided condition. In adding the tungsten to the silver colloid it is preferable to put in as much tungsten as the colloid will take and still retain the sticky qualities necessary to an easy manipulation of the product. After obtaining threads or filaments of the desired size and shape, and then drying to drive out any excess moisture, they are treated to convert the colloidal metal into the metallic state. This may be conveniently done by chemical methods, as by subjecting the colloid to the action of electrolytes or to the precipitating action of acid fumes. For instance, traces of HCl vapour may be blown over the threads of tungsten and silver colloid and thereby instantly convert the silver into the metallic state, in which condition it acts as a firm binding agent for the tungsten particles. The wires or conductors produced as above described have sufficient ductility to permit ready manipulation and mounting on lead wires. Some of the impregnated colloid may be used as a paste for securing the threads to the lead wires. The ductile metal, as, for instance, silver, gives the wire strength, while the refractory powder with which the silver is impregnated is in sufficient quantity to ensure a continuous wire after the silver is removed. The next process is to drive the ductile or low melting metal out of the wire and the pasted joint, and consolidate the refractory powder into a coherent conductor suitable for operation at high temperatures. This may be conveniently done by passing current through the threads or filaments in a vacuum or in an inert atmosphere and thereby vaporising the silver and sintering the tungsten particles together. The silver comes out entirely and the particles of tungsten draw together and consolidate into a strong wire. Capillary forces are very strong with metals which melt at high temperatures, and this phenomenon assists in producing a coherent product.—*Electrical World.*

BRUSSELS EXHIBITION.

(*Continued from page* 210.)

Messrs. Franco Tosi, of Legnano, Italy, have a noteworthy exhibit, the chief feature of which is a steam turbine of 4,500 h.p. at normal full load, capable of working up to 5,600 h.p. for ½ hour, coupled to a Brown, Boveri alternator, and destined for erection in the Porta Volta generating station of the Edison Co., of Milan. The turbine is designed for steam at a pressure of 12 atmospheres, and a temperature of 300° C., and runs at 1,260 r.p.m. As the turbine is of new design, we give a number of views showing its construction. Fig. 18 shows a complete set of the same dimensions as the one exhibited at Brussels, but with a different make of alternator, and slightly different valve-gear. It will be seen that the largest diameter of the cylinder occurs at the admission end, due to the fact that the rotor combines the de Laval and Parsons types, the steam being first expanded in nozzles and acting by virtue of its kinetic energy, and afterwards being further utilised by virtue of its pressure. The steam enters through diverging nozzles of the type shown in fig. 22, the number of nozzles open at a time being varied in accordance with the load; the velocity wheel is arranged in two stages, with stationary guide blades between, and in the larger sizes of turbine there is a second velocity wheel of similar type. A rotor with two such wheels is shown in fig. 20, in course of blading, and it will be seen that the blades are fixed by a special method, the bases being grooved to fit into corresponding grooves in the wheel, while at the top of the blades there are projections which fit into the shrouding and are riveted over, a device which gives great rigidity and security against strains due to centrifugal force. Between the velocity wheels there is a stuffing box of the labyrinth type, the rings being turned on an extension of the rotor drum. Beyond the velocity wheels comes the blading of the usual Parsons type. A complete rotor with single velocity wheel is shown in fig. 19, which also illustrates the method of balancing the rotor; it will be seen that the rotor is mounted on bearings and driven by a belt on the packing rings. By this means the balance of the rotor can be adjusted before placing it in position in the cylinder.

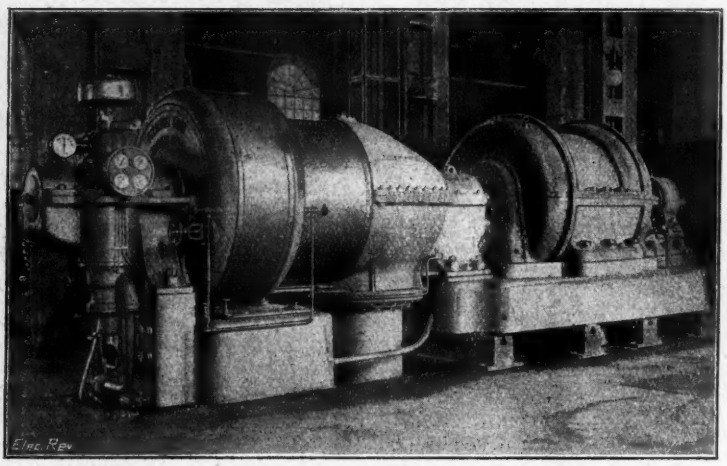


Fig. 18.—Franco Tosi 5,000-h.p. Steam Turbine.

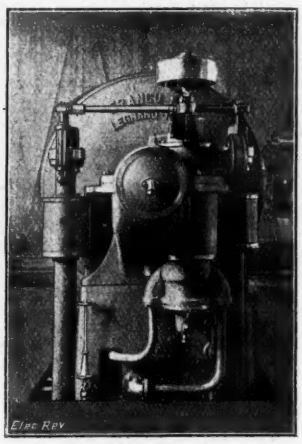


Fig. 21.—End View.

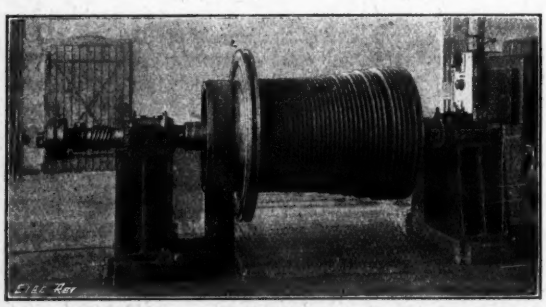


Fig. 19.—Balancing a Rotor.

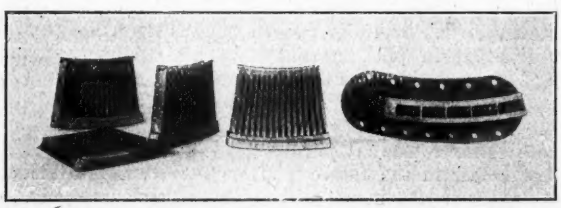


Fig. 22.—Blades and Nozzles of Tosi Turbines.

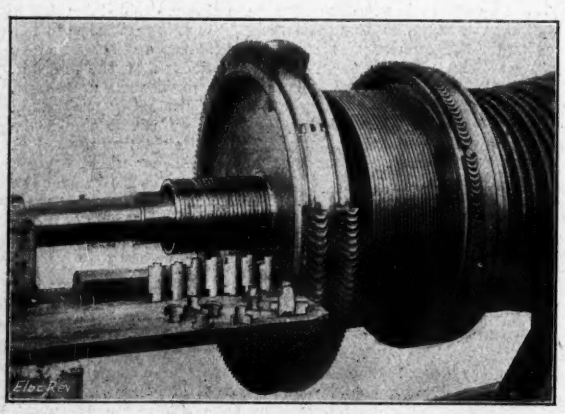


Fig. 20.—Rotor, showing Blades.

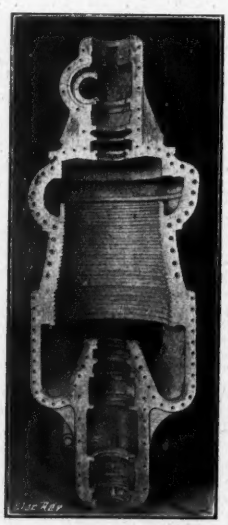


Fig. 23.—Interior of Cylinder.

Fig. 23 shows the interior of half of the cylinder, and fig. 22 shows some of the stationary guide blades which are assembled in segments and dovetailed into the shell.

A special type of stuffing box and thrust bearing is employed,

the rotating part of which is seen on the end of the rotor shaft in fig. 19. This is surrounded by a chamber into which oil is pumped under pressure, and the bearing and chamber are divided into two parts by a central disk, with labyrinth packing on the periphery. The relative dimensions of the two halves of the thrust bearing are such that a resultant axial pressure is set up by the oil acting on the rings, balancing the axial thrust of the rotor, the oil at the same time preventing metallic contact between the members of the bearing, and thus eliminating wear. Oil is pumped to the bearings, &c., by a simple rotary pump driven by the rotor shaft, the oil being passed through a tubular cooler on its way to the working parts. An auxiliary steam pump is employed for this purpose before the turbine is set in motion, and as the valves are operated by oil pressure, a valuable safeguard against the omission to start the oil pump is thus obtained, for the turbine cannot be started, and if running cannot continue in operation, unless the oil supply is duly maintained.

The main stop-valve is of the Ferranti type. The governor, of the centrifugal type, controls a double-beat balanced valve by means of oil under pressure, acting on a relay piston; and in the case of turbines fitted with automatic control of the number of nozzles in action, the nozzle valves are similarly controlled. The turbine shown in fig. 18 is, however, provided only with hand regulation for the nozzles. An emergency governor is also provided, which, on the attainment of 15 per cent. above the normal speed, allows the oil pressure to drop, thus closing the stop-valve. When the speed falls to normal, the oil pressure is restored, and the steam is readmitted.

The condenser is of the counter-current type, and is provided with reciprocating air-pumps and a centrifugal circulating pump, both electrically driven.

Since the firm of Franco Tosi commenced the construction of steam turbines, it has supplied or has on order a total of 175,000 H.P., in sizes from 225 to 12,000 H.P., as well as 90,000 H.P. for marine propulsion.

MESSRS. BROWN, BOVERI & CO., of Baden, Switzerland, have an exceptionally large and interesting exhibit of their latest and most important classes of work. A general view of their stand in the Machinery Hall is given in fig. 24; it shows a turbo-blower rated at 1,200 H.P. at 3,000 R.P.M., capable of delivering 28,600 cb. ft. of air per minute at a pressure of 11 in. of mercury, at that speed, or 35,500 cb. ft. at 7·1 in. at 2,450 R.P.M.—a very large output for the size of the blower; a three-phase turbo-alternator of 1,000 KW. output; a motor-generator running at 2,400 R.P.M.; and a three-phase transformer of 600 KW. There is also a working exhibit of the firm's electric train lighting system. The turbo-alternator runs at 2,400 R.P.M., and generates current at 400 volts, 40 cycles; it is provided with a condenser below the turbine, and a switch column carrying the controlling apparatus. This set supplies part of the energy used in the Exhibition, and will afterwards be installed at the "Louisiane" Cotton-spinning Mills, Ghent.

In addition to the apparatus on their stand, Messrs. Brown, Boveri & Co. supplied the generator coupled to the Tosi turbine, giving 3,000 KW. at 3,800 volts, 42 cycles; the three-phase motors, of 105 and 30 H.P. respectively, which drive the condenser pumps are also made by Messrs. Brown, Boveri & Co., and a Deri single-phase commutator motor driving a ring spinning frame on Messrs. Dobson & Barlow's stand, on the Brown, Boveri variable-speed system, was built by their licensees, the Lancashire Dynamo and Motor Co., Ltd.

(To be continued.)

EXPANSION OF PIPES.

MR. RALPH C. TAGGART, in a paper presented to the American Society of Civil Engineers, deals in a mathematical manner with the expansion stresses in pipes. He gives the usual figure of 29 million for the modulus of elasticity E of wrought-iron, and its

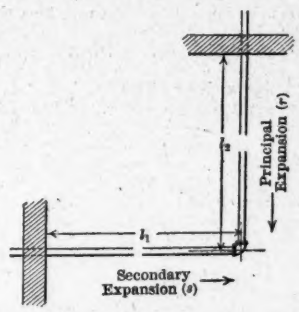


FIG. 1.

expansion coefficient C per unit of length as 0·00000673 per degree Fahrenheit; whence E × C = 195·2 lb. per sq. in. per degree, or 19,520 lb. per 100° F. change of temperature, an amount which exceeds the safe working strength of the iron, especially at joints where the pipe thickness is reduced by the threading. Now at least 150° F. must be provided against. Usually expansion is provided

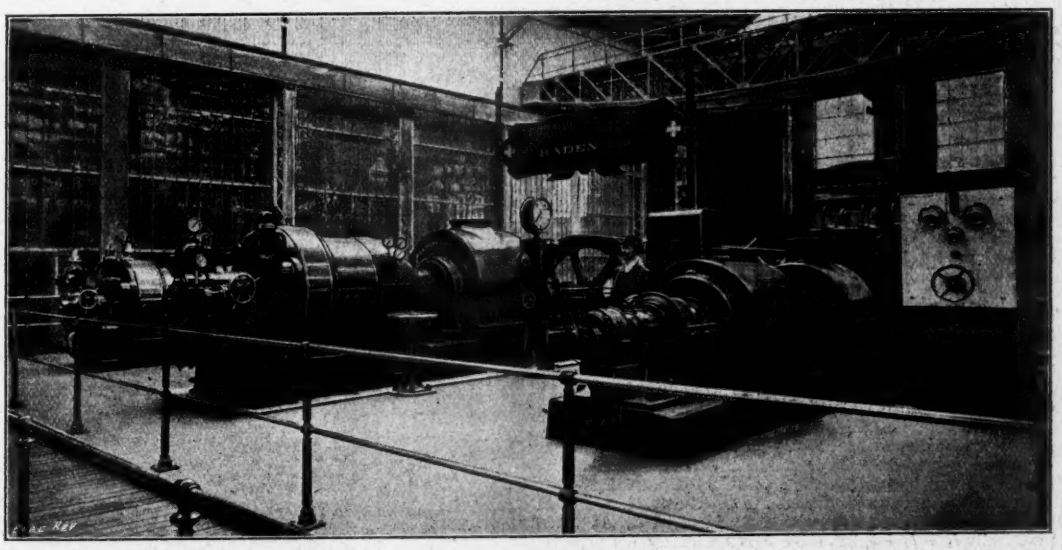


FIG. 24.—Messrs. BROWN, BOVERI & CO.'s EXHIBIT.

The motor-generator is interesting on account of the high speed at which it runs. It consists of a three-phase A.C. motor with short-circuited rotor, rated at 500 H.P. when supplied at 4,000 volts, 40 cycles, coupled to a D.C. generator of the turbo type, giving 400 KW. at 440 to 500 volts, with a direct-coupled exciter. The necessary switchgear for these machines is provided alongside them. The transformer is used as the connecting link between the turbo-alternator and the motor-generator, the Exhibition supply being D.C.; it is of the oil-immersed type, without artificial cooling.

The train-lighting equipment includes an 18-volt dynamo, nine storage cells, and a Brown, Boveri automatic regulator; the dynamo is belt-driven from a running axle mounted on bearings, and driven by a single-phase commutator motor. The load consists of nine metallic-filament lamps, which can be switched on and off, while the speed of the dynamo can be varied from zero to the maximum by altering the position of the brushes on the commutator of the motor, to demonstrate the working of the system.

for by the now common bends, but special disk and sliding expansion pieces are still used, and usually give trouble. The large disk usually gets scaled at its lower edge and ruptures there, and the telescopic joint is apt to corrode. It may be stated here that these telescopic joints ought always to have safety bolts in case of failure of the pipe anchorages. Recognising that the springing of the pipe is the now usual system of relief, the author has worked out a number of curves for pipes from ¾ in. to 20 in. diameter.

He assumes a case as in fig. 1 of two pipes l_1 and l_2 connected by a 90° elbow, the lengths l_1 and l_2 being the distance to some point which holds the pipes in line. Thus, there are two movements of the pipe ends near the elbow: a primary movement due to direct expansion of one pipe, say, l_1, and a secondary lateral movement, the transverse movement due to the linear expansion of l_2.

The secondary expansion being assumed nil, all expansion acting

at right angles to l_1, then the length l_1, when l_2 becomes nil will be, for any given expansion, such that—

$$l_1^2 = 87{,}000{,}000 \text{ D } r/f \text{ ; where}$$

l_1 = length of pipe in inches,
r = expansion in inches,
D = outside diameter of pipe in inches,
f = maximum fibre stress per square inch in pounds.

The maximum strain occurs at each end of the pipe. In the above equation the following relations hold true:—

Other quantities remaining constant, f varies directly as r, or for a fixed length and size of pipe, the maximum fibre stress varies directly as the amount of expansion.

Other quantities remaining constant, f varies directly as D, or for a fixed length and expansion of pipe, the maximum fibre stress varies directly as the diameter of the pipe.

Other quantities remaining constant, r varies inversely as D, or for a fixed length and maximum fibre stress, the expansion varies inversely as the outside pipe diameter.

Other quantities remaining constant, f varies inversely as l^2, or for a fixed pipe diameter and expansion, the maximum fibre stress varies inversely as the square of the length.

Other quantities remaining constant, r varies directly as l^2, or for a fixed pipe diameter and maximum fibre stress, the expansion varies directly as the square of the length.

If the length l_2 is to be considered, as well as the length l_1, the solution of the problem becomes much more complex, but can be worked out in a manner similar to the solution of the problem of a continuous girder.

Consider first a pipe with two lengths, l_1 and l_2, at right angles, joined together with an elbow at a, fig. 2. The lengths $a\,c$ and $a\,d$, or l_1 and l_2, are supposed to represent the distances from the elbow to the points at which the pipes pass through walls or are otherwise held at all times in line. Consider now that an expansion occurs in the pipes, with a slight movement, if necessary, through the two restraining walls, so that the pipes assume the new position, c-b-d. Assume the principal expansion to be at right angles to l_1, or in the direction, l_2, and the secondary or smaller relative expansion will be at right angles to l_2, or in the direction, l_1. The secondary expansion need not necessarily be less in quantity than the principal expansion, but it is to be less than $(l_2/l_1)^2$ times the principal expansion. The reason for this will become apparent, and is due to the fact that the expansion largely cared for by l_1 is that at right angles to l_1, and, similarly, the expansion largely cared for by l_2 is that at right angles to l_2, and also because the expansion varies as the square of the length of pipe under strain.

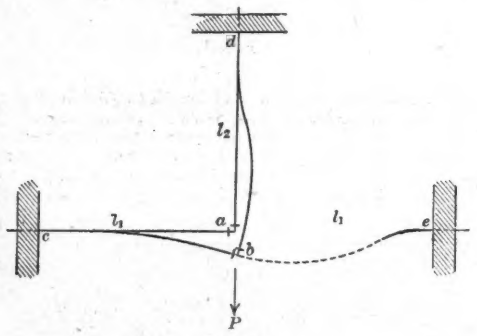


Fig. 2.

Now consider the length, b-d, swung through 90°, with the point, b, as a centre. It will assume the new position, b-e. This will in no way change the conditions of stress, if the elbow is considered as a part of the pipe, and it will give an arrangement to which the formula for continuous girders can easily be applied. The walls at c and e are points of support, and the pipes may be considered as horizontal at these points.

The unknown load, P, will act at b. The difference in elevation between c and b, will be called r, and the difference in elevation between b and e will be called s. The principal expansion is then equal to r, and the secondary expansion to s. The total horizontal length between c and e will also be considered as $l_1 + l_2$. It is, in fact, practically $l_1 + l_2 + s$, but since s is ordinarily a negligible quantity, as compared with l_1 and l_2, it will be neglected in this connection, although it may be considered in any special case, if desired.

This is worked out at great length, and the result found is

$$l_1^2 = -3 \text{ D E } r/f = -87{,}000{,}000 \text{ D } r/f,$$

which is the same as the first equation.

The marked out curves are calculated for a number of cases of a fixed expansion at right angles to l_1, and for a zero expansion at right angles to l_2. The original paper must be studied for the reasoning and remarks.

A bend is under such conditions of stress that one of 90° has approximately the same strength as a pipe making a 90° turn with an elbow, the two sides of which are each equal to the radius of the bend, but a bend is better than an elbow junction in respect of less resistance to flow.

Since larger pipes are so very stiff, two smaller pipes can sometimes be used to advantage, the two smaller pipes having not less area of cross-section than the one larger pipe they replace.

The chief item of interest in the paper as a practical deduction is the endorsement of the practice of putting negative stress upon pipes when cold. Why this is not done more is not easy to understand. If a given pipe is to expand 2 in. when hot, there is good reason to make it 1½ to 2 in. short when cold, so that when hot it is under little or no stress. It is sound sense to employ what the author calls cold strain, for when hot and free from stress the joints stand a better chance of being tight.

Constant trouble with pipes has been cured by inserting a shorter length at some point so as to enable negative stress to be put upon the cold pipe.

Then the joints will remain tight when the pipe is hot and has expanded out its cold strain. The paper is an interesting one, but too highly mathematical for most readers.

HOW TO DISCOURAGE EXPORT TRADE.*

Almost all our manufacturers profess anxiety to cultivate business with the Colonies and with foreign countries, but a few, we are afraid, conduct their business in a manner which is not calculated to encourage firms abroad who would like to trade with them. The practice of dealing with customers overseas through the intermediary of a merchant house at home is much more common in this country than it is on the Continent, where manufacturers are usually eager to establish direct relations with consumers; and this is, perhaps, fortunate for us, for the merchant generally knows just how to deal with the man at the other side of the water, while the manufacturer, through want of adaptability and ignorance of foreign ways, too often contrives to get at cross-purposes with the user of his goods, if brought into direct contact with him. Sometimes, also, we are afraid, our manufacturers wantonly throw away their chances of establishing a direct overseas trade. The two instances given below, which have recently come before us, illustrate this unfortunate want of business habits.

In the first case, a hardware dealer in Australia, seeing a description of a new machine in the pages of the *Ironmonger*, wrote to the maker, who carries on business in Yorkshire, for further particulars. This was in January, 1909. The manufacturer promptly replied, sending his catalogue and offering the Australian firm his agency. Almost by return of mail he received a trial order for one of the machines, accompanied by a bank draft for £15. The receipt of the money was acknowledged and the draft cashed, but the order was not executed. The Australian wrote again, and after waiting the better part of a year, was advised by the manufacturer, on November 11th, 1909, that the goods were "now in hand," and would be dispatched within a week or so. Nothing further, however, was heard about the matter, and in the beginning of the present year the Australian firm brought the facts to our notice, and asked for our intervention. We sent a representative to interview the manufacturer, and were told that the goods were ready (this was in March, 1910), but that, before sending them off, the manufacturer was awaiting a remittance for 18s. to cover the cost of the packing cases! This was the first time that the question of packing had been raised, and the Australian customer was naturally much vexed at what he considered a frivolous and unreasonable demand, especially in view of the fact that he had paid for the goods more than a twelvemonth previously. A few weeks ago we were informed that the goods had actually been shipped, the Yorkshire manufacturer, with a large-mindedness which seems almost incredible judging by his previous attitude, consenting to wait for his 18s. until the merchandise has reached its destination.

In the second case, an ironmonger in a large way of business in Holland, sent an order to an English manufacturer of a horticultural specialty, with whom he had done business once or twice before. The order was accompanied by cash, and by instructions to send the goods packed in a manner which was plainly stated, so as to conform with the requirements of the Dutch market. The manufacturer did not reply for 10 days after receipt of the order; then he sent the goods packed in a way different from that ordered, advising his customer that "he would find they came cheaper packed that way." The firm in Holland replied that they wanted the goods packed as ordered, and complained that through the delay and the wrongful shipment they were disappointing their customers, to whom they had re-sold the articles in small quantities. They informed the manufacturer that they were returning the useless goods to him, and asked to be credited for the carriage they had had to pay on them, and either to be supplied with goods as ordered or to have their money returned. To this the manufacturer answered that he would send goods packed as ordered "as soon as he could," but that he was out of stock of this variety at the time. He also refused either to refund the carriage on the wrongly packed goods or to return the Dutch firm their money. The goods in substitution for the wrongly-packed articles, however, were not sent for two months, and in the meantime the season was drawing to an end. After having received the original order on January 29th, the manufacturer, on April 19th, wrote to his customer:—

"I am extremely sorry for the long delay in sending the goods, but this cannot be helped, and I will send as soon as possible. I hope to execute the order in another week's time."

The Dutch firm, at the end of their patience, replied to this by postcard asking either to be supplied with the goods they had paid for, or to have their money refunded, failing which they would

* *The Ironmonger.*

take proceedings. This card drew from the English manufacturer the following extraordinary reply :—

"Your postcard is most libellous, and if you were in this country you would know about it. We have sent you the goods once, and our reason for not sending the articles packed as ordered has been fully explained to you."

The firm in Holland, as subscribers to the *Ironmonger*, asked us to take the matter up for them, but our courteous letters drew nothing but a brusque reply, scornfully referring to the Dutchman as "this person," and telling us to mind our own business.

The end of the story was that the Dutch firm had to place their order with another English house at an increased price, besides which they were called upon to pay Customs duty in Holland, not only for the first parcel, which they had to return, but also for the second.

It is not suggested that the two cases referred to above are typical of the manner in which British manufacturers treat their customers. On the contrary, they are exceptions to the rule of fair and businesslike dealing, and where manufacturing firms with a large and well-established foreign trade are concerned, such neglect of elementary commercial principles is, of course, not to be expected. But at a time when all our manufacturers, even the most important, have to go out into the world's highways and byways for orders, often in severe competition with Continental and American rivals, transactions such as these bring a discredit upon our national reputation for fairness and promptness in business out of all proportion to the money value of the orders involved. And perhaps the most disagreeable feature about them is that the manufacturers concerned are often (as they were in the two cases referred to) so thickly encased in stolid self-sufficiency that they cannot conceive that they have done anything which is open to criticism.

BRITISH MEDICAL ASSOCIATION.

At the annual meeting of the Association, which was held at the University of London (Imperial Institute Buildings) at the end of last month, there was an interesting exhibition of instruments and drugs, &c., including a special section devoted to electrical apparatus. The principal manufacturers of X-ray and electro-therapeutic apparatus were well represented, and the latest developments in the direction of rapid radiography, &c., were shown. Messrs. Siemens Brothers & Co., Caxton House, showed several interesting novelties, including their "G. P." X-ray outfit, designed to facilitate the adoption of radiography by the general practitioner; an X-ray outfit with rotating high-tension rectifier; a diathermy apparatus; universal electromedical apparatus, and the "Skiafix"—a new apparatus for clamping the body of a patient in any desired position for taking radiograms. Of these, the "Diathermy" apparatus was, perhaps, the most interesting, as it was the most novel, being used for the production of heat in the interior of the body by means of high-frequency currents. The principle upon which it acts is analogous to that of wireless transmission; a transformer is used to charge the condenser of an oscillatory circuit, which excites the primary of a Tesla transformer, and the oscillations induced in the secondary of the latter are transmitted into the body. By this means heat can be generated deep in the body tissues, without over-heating the superficial layers, and remarkable results have been obtained in connection with various complaints. The frequency employed is from 600,000 to a million oscillations per second, and the current strength may be up to 2·5 amperes, without pain or danger to the patient.

The "G.P." outfit is illustrated in fig. 1. It consists of a 16-in. spark coil; small switch-table with ammeter, rheostat and switches; Wehnelt interrupter; tube and stand, fluorescent screen, milliammeter, &c. All the apparatus are fixed to the screen.

The X-ray outfit with rectifier, which we also illustrate (fig. 2) is a new pattern, of a more elaborate character than the "G.P." The leading feature of it is the high-tension rectifier, which is constructed on the lines of a rectifying commutator, giving unidirectional impulses of twice the frequency of the alternating current supplied. The reversal takes places at zero current, so that inverse current, which is injurious to the tubes, is entirely prevented, and the regularity of the alternating current as compared with that obtained with interrupters is of great advantage in securing steady and sharp screen pictures and accurate dosage of the rays. The apparatus consists of a switch-table with the necessary instruments, switches and rheostat, and the X-ray generating plant, in a sound-proof oaken case, which contains a self-starting single-phase synchronous motor, the rotating rectifier, transformer, milliammeter and switch. The shaft of the rectifier runs in ball bearings, and special care has been taken to ensure freedom from breakdown of insulation due to the high pressure. The apparatus can be supplied for use on either D.C. or A.C. circuits. Fig. 3 shows a new pattern of Universal Electro-medical Apparatus for therapeutic and surgical purposes, such as galvanisation, electrolysis, cautery, &c. The apparatus, which is very compact, is entirely free from earth connection, and it is impossible to get a shock from any part of it, the current used for galvanisation and lighting being generated by a small motor-driven dynamo. The continuous current is non-pulsating, and separate circuits are provided so that several different operations can be carried on simultaneously.

Another very interesting exhibit is a variety of dental instruments made of tantalum, a metal which Messrs. Siemens first brought into commercial use, and which is particularly well adapted for certain dental purposes, being proof against the attacks of all acids, except hydrofluoric acid.

Messrs. F. Davidson & Co., of 29, Great Portland Street, W., exhibited amongst other items their "thermogenerator." This is a form of thermopile for use with surgical lamps, and for cautery, &c., and offers advantages where a supply of electricity is not available.

The Sanitas Electrical Co., Ltd., 61, New Cavendish Street, W., had a comprehensive exhibit of "Sanax" apparatus, including intensified spark coils, a motor mercury interrupter giving up to 10,000 interruptions per minute, and a variety of X-ray apparatus, baths, vibrators, &c. With their X-ray outfit, instantaneous radiography with exposures of $\frac{1}{100}$ second can be accomplished, employing the coil and interrupter above-mentioned. Their earth-free "Multostat" is a universal apparatus for general therapeutic purposes, provided with a separate dynamo driven by a motor, so as to isolate the apparatus from the mains.

Messrs. K. Schall & Son, 75, New Cavendish Street, W., showed X-ray apparatus, high-frequency apparatus for thermo-penetration, "Pantostats" (*i.e.*, universal apparatus), &c., and the Dowsing Radiant Heat Co., Ltd., 24, Budge Row, E.C., exhibited their radiant heat treatment apparatus.

The Medical Supply Association, 228, Gray's Inn Road, W.C., showed apparatus for rapid radiography and radiotherapy, universal apparatus, &c. Messrs. W. Watson & Sons, Ltd., 313, High Holborn, W.C., had a number of new accessories on view. Messrs. H. W. Cox & Co., Ltd., 47, Gray's Inn Road, W.C., showed their spark coils and a variety of X-ray and high-frequency apparatus. Messrs. Newton & Co., 3, Fleet Street, E.C., showed their English-made Snook Röntgen apparatus, Apps-Newton spark coil, Universal apparatus and X-ray tubes. Mr. A. E. Dean, 82, Hatton Garden, E.C., showed a complete modern equipment for radio-diagnosis, perfectly safe to the user, and designed to afford the utmost facility and convenience, as well as a special couch for radiography, X-ray tubes, &c.; all his apparatus is entirely London made, and many of the principal British hospitals are using his plant. Messrs. F. R. Butt & Co., 11, Denmark Street, W.C., who show a new mercury interrupter, coil and couch, also make a special feature of their British-made apparatus. Messrs. Longstreth's, Ltd., 190, Queen's Road, Battersea, showed the Lithanode specialities, portable batteries, &c., for medical and other purposes.

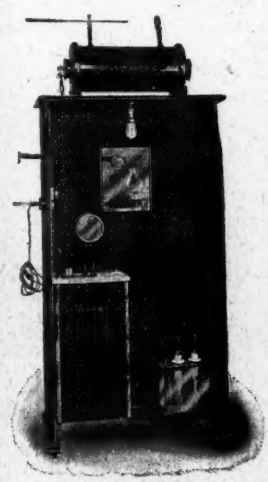


Fig. 1.

Fig. 2.

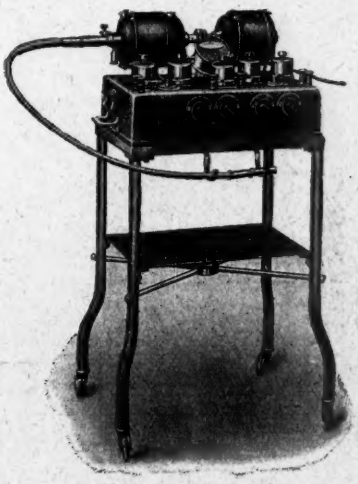


Fig. 3.

Siemens X-ray and Electromedical Apparatus.

E

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Switch-Type Fuse Boxes.

Some time ago Messrs. Reyrolle & Co., of Hebburn-on-Tyne, introduced a series of switch-type fuse boxes in which the fuse holders are attached to the lid of the box, which, of course, must be opened and withdrawn from all contact with the circuit in order to replace a fuse.

The boxes have fireproof linings and all current carrying parts

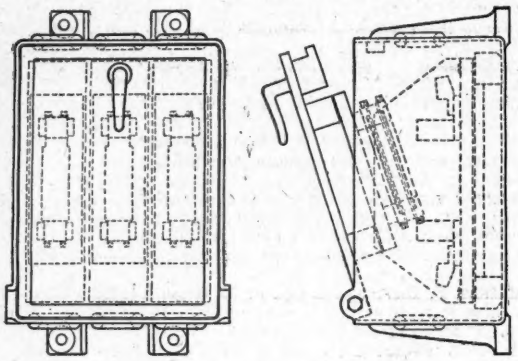


Fig. 1.—Triple-Pole Switch-Fuse Box.

are mounted on porcelain or slate. The fuse wire is enclosed in a fireproof tube, with a view to providing against heavy short circuits.

So far as safety in rewiring is concerned, it is obviously unnecessary to have a switch in circuit with these fuses. The switch-type fuse boxes are made in single, double and triple-pole types (one of the latter being illustrated herewith) and in sizes up to 100 amps., single-pole pattern, and 400 amps., double and triple-pole patterns.

The "Anchor" Patent Grip.

The accompanying illustrations show the patent grip which is now being placed on the market by the Electrical Conduit and Fittings Co., of Anchor Works, Birch Street, Walsall. It is extremely simple, and has no loose parts. As shown in fig. 2, a

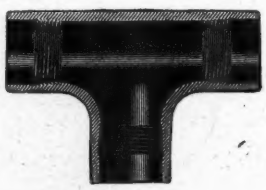


Fig. 2.

taper thread is formed in the fittings; the end of the conduit is fitted into the socket and given a half-turn with a fair amount of pressure, driving it into the grip, with which it makes a good metallic contact as in fig. 3. There is nothing to be seen outsid

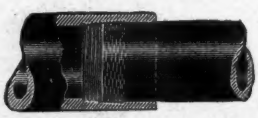


Fig. 3.

the fitting, which therefore presents a perfectly neat appearance, and no screwing tackle is required. The device combines electrical continuity with a strong mechanical joint, and should prove very useful to contractors.

Bamber's Non-encrusting Zincs.

An interesting improvement in zincs for primary cells has been made by Mr. C. K. Bamber, who has devised a process for amalgamating zinc electrodes throughout their substance in such a way that they remain amalgamated to the end of their working life. The details of the process are not disclosed, but it involves the use of mercury. Zincs amalgamated in the ordinary way work well for a time, but the effect is only skin deep, and after a short period of use they lose their protection, and are no better than untreated zincs; the consequence is that local action is set up, and the rods are also unequally attacked, with the result that they fall in pieces, and have to be scrapped while still only half consumed.

From the samples we have seen, it would appear that the Bamber zincs are entirely free from these defects; their surface does not become encrusted, so that they can be cleaned by merely wiping them, and they are consumed uniformly all over, with the result that they do not disintegrate, and can be used up to a mere shred. Tests carried out by Mr. T. Kerr-Jones show that, as might be anticipated, the E.M.F. and current generated with the Bamber zincs are consistently higher than with ordinary amalgamated zinc rods, and that the former last from two to four times as long as the latter, under equal conditions. They have also been tested in practical working by various railway companies, whose reports fully bear out these conclusions, and the zincs give good results in Daniell and bichromate as well as Leclanché cells. They are to be obtained from the Eyre Smelting Co., Ltd., Barden Road Works, Tonbridge, Kent.

We understand that many thousands have already been supplied to railway companies, &c., and an electric clock company has been particularly pleased with them as solving the problem of finding a cell that can be depended upon for reliable work over long periods.

Fuse Carrier, Battery Regulating Switch, &c.

Messrs. Drake & Gorham, of Victoria Street, S.W., have recently put on the market one or two specialities, of which the following are particulars:—

The fuse carrier, illustrated, has been designed in order to meet the New Home Office Regulations; the fuse wire is entirely

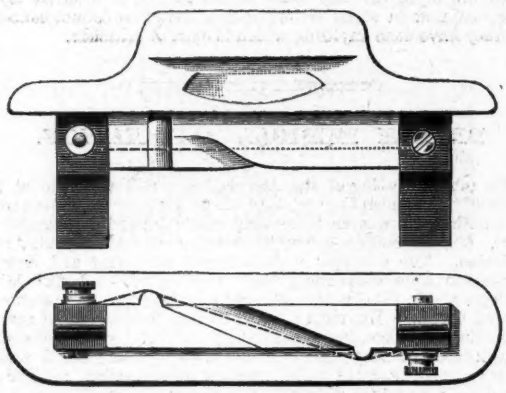


Fig. 4.—New Porcelain Fuse Carrier.

protected from the hand, and it is impossible to touch any live metal whilst inserting the carrier into the clips. The fuse wire being taken from one side of the porcelain bridge to the other, prevents one fuse effecting the other when it blows, as it is impossible to insert a carrier in any other way than with the porcelain adjacent to the fuse wire of the adjoining carrier.

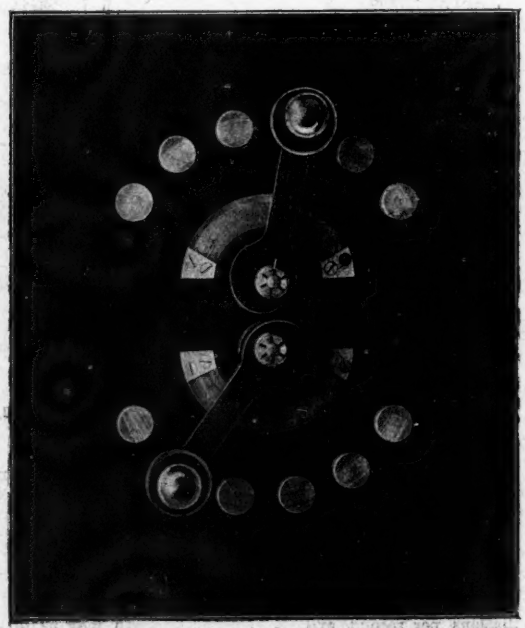


Fig. 5.—Improved Battery Regulating Switch.

It will be seen that their registered pattern obviates a very common fault in fuses of the channel type, namely, that the fusing point is unreliable owing to the wire touching the porcelain for part or the whole of its length. The wire is carried round two projections

and is not only kept clear of the porcelain, but the actual working length is always the same. The carriers are made to suit the following dimensions between the clips :—5-10-ampere size 2½ in., 25-ampere size 3 in. and 50-ampere size 3½ in.

The second illustration is of an improved and cheaper type of this firm's well-known battery regulating switch which they have recently patented. This is absolutely "foolproof" owing to an eccentric cam on each arm making it impossible to move the

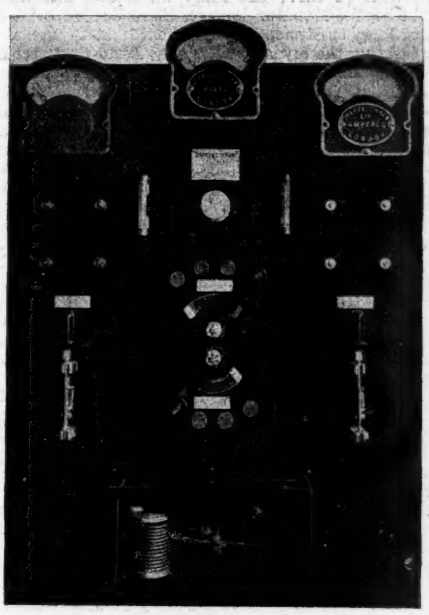


Fig. 6.—Standard Switchboard for Small Plant.

discharge arm in front of the charge arm ; therefore, the attendant cannot, when using this switch, reverse the regulating cells whilst running the plant when lights are in use.

The switch is fitted with Pilot brushes and short-circuiting resistance when required.

The third illustration is of one of Messrs. Drake & Gorham's standard switchboards for small plants fitted with this regulator which, we understand, they keep in stock in 25-ampere and 50-ampere sizes.

LEGAL.

On Sale or Return.

In the Shoreditch County Court on Tuesday last week, before his Honour Judge Smyly, K.C., Messrs. Julius & H. Grevener, of Eldon Street House, E.C., electrical fittings merchants, sued Mr. J. Manti Smith, of Hanleigh Palace and Skating Rink Co., Bury Old Road, Bolton, Lancs., to recover £14 0s. 3d. for electrical fittings supplied.

Mr. Reginald White appeared as counsel for the plaintiffs.

Mr. Booker, an electrician, was called, and said he was in charge of the plaintiffs' Manchester branch in September, 1909. He negotiated with the defendant to supply arc lamps to the value of £10, and carbons to the balance of the debt. It was agreed that they were on sale or return for 14 days. From that time they heard nothing until payment was pressed for, when there was a query as to the current taken by the lamps, and that was put right. Since then accounts had been rendered regularly, but nothing had been paid.

The Defendant said the lamps were sent on approval to be tried, and it could not be done in a minute. He found they burned far too much electric current, and decided to reject them, but offered to pay for the carbons, as they were all right.

Judge Smyly : How long were the lamps used ?—About three months.

But surely you are not entitled to use electric fittings for three months and then reject them ?—My agreement was that I should have them a reasonable time for testing, but no definite period was fixed.

Judge Smyly : But can you call three months a reasonable time ? It seems very unreasonable to me.

Defendant objected to being brought to London from Bolton when the affair was arranged in Manchester.

Judge Smyly : The contract was made in Manchester, and it is a great hardship bringing a man up all this way.

Mr. White said he was confident that the defendant must have known he was dealing with a London house, but the defendant said that was not so, as plaintiffs had a permanent office in Manchester.

Judge Smyly decided that the Court had no jurisdiction, and the action was dismissed, the defendant to receive his costs of coming to London.

Discount for Prompt Cash Only.

A decision of considerable importance was given by Judge Woodfall in the Westminster County Court on Friday, July 29th, in the case of George Ryder Ousey, trading as Messrs. Geo. Ryder Ousey & Co., *v.* the Electrical Fittings Co., Ltd. The latter placed orders with Messrs. Ousey & Co. for a particular pattern of flexible table standards at certain prices less 40 per cent. and 2½ per cent. The account was not settled during the month following the delivery of goods, and Messrs. Ousey & Co. wrote stating that they would be unable to allow any of the discount. After considerable correspondence they agreed to allow the 40 per cent., but not the 2½ per cent., at the same time stating that goods purchased in the future would only be subject to discount if settled during the month following delivery. Other orders were placed by the defendant company, and payment of the account was not made during the month following delivery. Messrs. Ousey & Co. then claimed the full list prices. The defendant company paid list prices less 40 per cent. into Court, but Judge Woodfall decided that they were liable for the full list prices.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Alternator" writes :—"As I buy a large quantity of petrol, which is used purely for (electrical) commercial purposes, I should be glad if you would tell me how I may obtain the rebate to which I am legally entitled. The petrol is bought from a large motor-car firm at special rates, but it is taxed as though used for motor-cars. The firm who supply the petrol inform me that they cannot obtain the rebate for me. Will you kindly inform me from whom I am legally entitled to claim this rebate (I believe it is 2d. per gallon), and also what legal formality, if any, is necessary ?"

*** The Finance Act, 1910, Sec. 85 (3), provides that if any person proves to the satisfaction of the Commissioners that he has within the previous six months used any quantity exceeding five gallons of spirit otherwise than for motive power for motor-cars, he shall be entitled to obtain a repayment of any duty *which has been paid* in respect of the spirit. Note that he need not prove that he has paid it himself. It is sufficient if he proves it has been paid. Our correspondent's best plan will be to write to the local Inland Revenue office, where he will get all the required information. We fancy that this matter has been dealt with in the rules made under and pursuant to the Budget. A copy of these could be obtained from Messrs. Eyre & Spottiswoode, London, E.C., for a few pence.

BUSINESS NOTES.

Bankruptcy Proceedings.—Walter Lee Grimsley, electrician, Eureka Motor Works, Bournemouth.—The first meeting of creditors herein was held on July 30th at the Arcade Chambers, Bournemouth. The liabilities amounted to £195 17s. 11d., with a deficiency of a like amount. The debtor commenced business in 1907 in partnership with a Mr. Ernest Elkins, under the style of Grimsley & Elkins, the latter introducing a capital of £130, but the debtor none. At no time does the business appear to have been a success, and in September last they converted a portion of the premises into a roller skating rink, but this, too, proved a failure, and the partnership was dissolved in March last, when the debtor took over the assets of the value of £5, Grimsley undertaking the liabilities of nearly £200. The matter was left in the hands of the Official Receiver.

Ernest Albert Thorn, house decorator and electrical engineer, 22, Mossbury Road, Clapham Junction, London.—This debtor attended at the Court House, Wandsworth, on August 4th, for his public examination. The statement of affairs showed liabilities £255 11s. 6d. and no assets. Debtor attributed his failure to loss on contracts and bad debts. He offered his creditors 6s. in the £, but they refused it, and he filed his petition. The examination was ordered to stand adjourned.

Harold Bristow, electrician, 368, Hessle Road, Hull.—The statement of affairs under this failure shows unsecured liabilities amounting to £172 2s. ; assets valued at £49 11s. 9d. ; preferential claims, £8 12s. 10d. ; and a deficiency of £131 3s. 1d. The estate remains in the hands of the Official Receiver for realisation.

Liquidations.—Highgate Hill Tramways, Ltd.—On July 29th it was resolved that the company be wound up voluntarily, with Mr. H. Wilson, 23, Devereux Court, Temple, E.C., as liquidator. A meeting of creditors will be held to-day.

The Rippingille Manufacturing Co., Ltd.—A meeting of the creditors of the above-named company will be held at 4, Waterloo Street, Birmingham, on August 18th.

Meter Approved.—The B. of T. has approved of the pattern and construction of the British Thomson-Houston mercury meter, type M.H., for the measurement of electrical quantity.

Consular Reports.—Italy.—The British Consul at Venice reports that most of the electrical equipments in use in his district are of foreign origin. There is now, however, an advance in the manufacture of such apparatus in Italy, and some foreign firms have considered it advisable to establish branch offices and open workshops in Italy. Great expansion in exploiting watercourses in the mountainous districts of Venetia for the supply of energy for power and lighting purposes over large areas has continued. The works connected with the hydro-electric plant at Ponte della Serra, near Feltre, are approaching completion. The large bar has already been finished, and the third dynamo has been placed in position. This plant will be capable of supplying 9,000 H.P. It is expected to be inaugurated this year. The two subsequent sections, which will have a capacity of about 6,000 H.P., will probably be commenced next year. Several powerful companies are interested in this venture—the Edison, the Adriatica and the Cellina. The works have been carried on under the supervision of the civil engineer, Signor Quarisa. The first part of the hydro-electric plant, commenced by the Società Bellunese per l'Industria Ellettrica, on the River Ardo, has recently been finished. The generating station has been erected in the Vezzano Valley. The water is taken at Corontola. These turbines and alternators were supplied by a Milan firm, and they are of 300 H.P., and generate at 6,000 volts. Other important plants are projected or building in all the Venetian provinces.

Mexico.—According to the *Boletin de la Oficina Internacional de las Republicas Americanas* great activity is being shown in the matter of the installation of electrical machinery in mines in Mexico. Large works are in course of construction in the river Conchas, near Santa Rosalia, State of Chihuahua, for the transmission of power to the mining districts of Santa Enlalia and Parral. This is the most important establishment of its kind in the Republic, and in addition several hydro-electric works on a smaller scale are proposed. The installation of an electric station on the Mayo river near Alamos, State of Sonara, has been approved by the Government, and for the purpose of supplying power to the towns and industrial enterprises situated in the district of the river Altar, Sonora, a new generating station is proposed. Moreover, new works are projected at Puente Grand on the river Santiago, near Guadalajara, with transmission cables to the mining districts of Etzatlan and Hostotipaquillo; the concession includes the construction of a dam in the lake Chapala. A concession has been granted for the utilisation of the waters of the river Matamoros, and a hydro-electric plant of 10,000 H.P. will shortly be constructed in the State of Hidalgo. In addition numerous concessions have been granted for the utilisation of various other rivers for the production of electrical energy.

The British Vice-Consul at Monterey reports that the Monterey Railway, Light and Power Co., by arrangement with the City Council, is about to lay 3 km. of underground cable to supply light and power in the main business portion of the city. This company is now engaged in remodelling its plant, and is installing five steam turbo-generators of 500 KW. each, which will supply power for the lighting service, the electric tramways, and to a number of factories, foundries, &c.

Tunis.—The Belgian Consul at Tunis reports that the imports of dynamos into the Regency of Tunis in 1908 amounted to 77,592 kg., valued at 163,178 fr., as against 215,563 kg., valued at 242,699 fr., in 1907. The principal supplying countries are France (51,813 kg.), Germany (12,126 kg.), Great Britain (7,746 kg.) and the United States (5,864 kg.). The imports of electrical apparatus and appliances amounted to 217,034 kg., valued at 496,860 fr., in 1908, as against 155,778 kg., valued at 276,301 fr., in 1907. The principal supplying countries are France (191,271 kg.), Great Britain (7,644 kg.), Italy (6,924 kg.), United States (3,505 kg.), Germany (3,366 kg.) and Belgium (2,341 kg.). The Cie. des Tramways de Tunis have electrical works at La Goulette, with a power of 3,500 KW., and a reserve power of 1,000 KW.; the price of electrical energy is 50 centimes per KW.-hour for lighting and 12 centimes to 40 centimes per KW.-hour for motive power; there are three three-phase alternators of 10,000 KW.; the transformer groups constitute three sub-stations with two converters each; the distribution is aerial, with a length of 11 kilometres towards Tunis and 12 km. towards Marsa; in the direction of Djebel-Djelland the transmission is underground and submarine, with a length of 15 km. to be extended shortly to 24 kilometres. The Cie. du Gaz de Tunis has electrical works at Tunis, and produces electricity by means of four gas motors of 100 KW. each, and two French engines of 300 KW.; each gas motor drives four dynamos, and the French engines each drive a dynamo of 150 KW. and an alternator of 150 KW.; there is also a battery of 800 ampere-hours capacity; distribution is at 250 volts, continuous and three-phase current; in the suburban districts the current is single-phase. The Cie. d'Eclairage Electrique de le Ville de Sfax has works of 210 H.P., erected at Sfax in 1908; the price of energy for lighting varies with the amount consumed from 20 centimes to 60 centimes per KW.-hour, and for motive power from 15 centimes to 40 centimes; the installation includes eight dynamos, without transformers or accumulators; the line is bare wire, and there are 200 subscribers for lighting and one for motive power. The Cie. Electrique de Sousse has works, erected in 1905, and including two groups of 64 KW., each composed of six dynamos, and one group of 20 KW. composed of two dynamos; the battery includes 138 cells of 700 ampere-hours. The development of the use of electrical energy at Sousse will shortly require the doubling of these works; the large works are continually increasing their demands, and new works are under consideration. The Mine du Djebel Ressas have two dynamos worked by two horizontal condensing engines of 125 H.P.; the installation includes a motor of 24 H.P. and an electric crane. The Cie. des Phosphates et du Chemin de fer de Gafsa have electric motors of 450 H.P. for loading purposes at Sfax, and of 70 H.P. for railway workshops. Other works producing electricity for their own use are the Usine Bouchart, at Sfax, with 5 H.P.; the Maison Portelli, of Sfax, with 4 H.P.; the Cie. des Phosphates du Dyr, at Kelaa es Senam and Kef Rebiba, with two dynamos and a transmission of 4 km. length; the Cie. des Phosphates Tunisiens at Kalaat-Djerda, Sif and Souetir, with 148 KW. continuous current and 240 KW. alternating current; the Société Minière de Fedj Assene at Ghardimaou; the Société Minière du Khanguet, with 12 H.P.; the Mine du Djebel Chouichia, with 18 H.P.; the Société Metallurgique des Mines de Beja, with 40 H.P.; the Ateliers Jarry et Siemens at Beja, with 10 H.P. (extensions proposed for lighting the town of Beja); the Mine du Djebel Hallond, with 100 KW.; the Cie. des Phosphates et du Chemin de fer de Gefsa à Metlaoui, with seven dynamos (extension proposed); the Société General des Huileries du Sahel Tunisien; the Minoterie Ganem et Ghez; the Société des Minoteries du Sahel Tunisien, with two dynamos; the Société Monastirienne pour le Traitement des Grignons par le Sulfure de Carbone; the Huilerie Seccuto at Monastir; the Huilerie Debono at Monastir; the Huilerie Casella at Monaster; the Huilerie Buntboul at Monastir; the Huilerie Medina at Monastir; the Briqueterie Post et Cie. at Djemmal. The works utilising electric energy produced by other works are:—The Ateliers Bertrand; the Cie. du Gaz de Tunis (produces itself, but also purchases from the Cie. des Tramways de Tunis); the Ateliers Baldnezoni at Sfax. There is a large opening for electrical supplies in Tunis; in the large centres the industrial establishments tend more and more to adopt electricity as motive power, and in the mines its use is developing considerably on account of the facility of transmission.

Russia.—The French Consul at Odessa, in a recent report, states that in 1909, after numerous delays and difficulties, a Belgian company secured a concession for electric lighting at Odessa, and works for the installation of electric traction on the tramways will probably be begun soon. Amongst the big works projected or already begun of interest to the electrical industry, one may mention the port works at Odessa, the establishment of a free port, and the projected electric railway from Sevastopol to Yalta. The inhabitants of the district of Berdiansk and Melitopol, and those of the valley of the Molotschna, are demanding the installation of telephone services, and the same conditions prevail in Theodosia and Ackermann. Moreover, it is proposed to supply the town of Halbstadt and district with electric lighting. This installation should be successful owing to the fact that the farmers find this method of lighting much safer for their granaries, cellars, warehouses, &c.

The imports of machinery in 1909 showed an increase in value, but a slight decrease in quantity. Imports from France, Germany and Austria increased, those of certain classes from the United Kingdom decreased, and there was a considerable decrease in the imports from Italy. The success of the German industry is due to advertisement, the zeal of the travellers, and the favourable terms granted. German manufacturers take the greatest care to satisfy their customers, and supply them with all the plans and drawings necessary. Importers of machines should be in a position to supply plans and drawings to the Customs in order to assist them in the matter of levying duty, and a circular requiring the production of such plans, &c., has been recently issued. Odessa is an important centre for machine construction, and the industry in general appears to be developing, although it will probably be several years before it can effectively compete with foreign makers. The principal agents in Odessa dealing in machinery and similar goods are:—E. Bayerlé & Co., 19, Rue Richelieu; Leon Isserlis, 5, Rue Tiraspolskaia; Wilhelm Mayer; J. Rabinow; J. E. Ransome, Rue Grecque; Henry Rodgers, Voienni Spousk; Adolphe Weissmann, Rue Polskaia. In Kieff there are H. Bielsky; M. O. Horovitz; Olszevitz and Kern; H. Smulh & Co.; Vielwerth & Dedina; W. H. Hofe Camptell; Würgler Frères. In Rostow there are Emmanuel Eissen, 126, Grande Sadovaia; E. and A. Deines. The trade in motors is one of the most interesting for foreign manufacturers by reason of the openings in existence in the district. The trade is at present chiefly in the hands of German and Swedish makers, and the only means of competing with them would be to have specimen machines on the market to serve as advertisements, and to employ engineers on the spot, capable of explaining the working. Long credits, sometimes as much as two years, have to be given, and it is essential that a reliable and competent agent thoroughly versed in the commercial customs of the district should be employed.

Trade Announcements.—Mr. F. W. Parkes, representing Messrs. Crompton & Co., Ltd., Messrs. W. T. Henley's Telegraph Works Co., Ltd., and Messrs. The Sunbeam Lamp Co., Ltd., informs us that he is removing to-day from Grosvenor House, Belfast, to more suitable premises in Faraday House, Queen Street, Belfast.

The Telegraph Condenser Co., Ltd.—On and after Monday, August 8th, the works will be removed from 175A, Peckham Park Road, Peckham, S.E., to Vauxhall Street, Kennington Oval, where all communications should be addressed.

Mr. A. Brooke has taken over the business of Messrs. Fox and Co., electrical engineers, of Bradford Road, Batley (Yorks.).

Mr. Alf. E. Croager, of Norfolk House, Laurence Pountney Hill, E.C., has been appointed London representative to Messrs. Joseph Williamson & Co., Ltd., screwing machine makers.

Messrs. Tetley & Co., of Falcon Electrical Works, Manchester, have appointed Messrs. J. Parkinson & Co., Post Office Chambers, St. Nicholas Street, Newcastle-on-Tyne, as their sole agents for Newcastle and district.

Catalogues and Lists.—The Electrical Conduit and Fittings Co., Anchor Works, Walsall.—Illustrated catalogue and price list of "Anchor" conduits and fittings for electrical installations—including the new "Anchor" patent grip for continuity, consisting of a taper thread in the fitting, by which the tube is readily gripped without the use of screwing tackle.

Berry Construction Co., Ltd., 29A, Charing Cross Road, W.C.—Price list No, 14, describing the latest "Tricity" cookers and cooking ranges, suitable for both A.C. and D.C. circuits, and reduced in price. The cookers are single or duplex, the latter having two hot plates, each consuming 800 or 200 watts, as desired; separate hot plates are also provided, for use alone or in conjunction with other apparatus, and a large variety of simple and cheap utensils, ovens, ranges, &c., has been developed for use with the heating elements.

Mr. G. Braulik, 8, Lambeth Hill, E.C.—Revised price list of electric fans and small D.C. motors.

Messrs. Albert Durst & Frankl, 57-58, Chancery Lane, W.C.—Circular and sample of machinery sponge cloths, which it is claimed are much more economical than meat cloths, cotton waste, &c.

Mr. Harry Moss, 116, Horton Grange Road, Bradford.—Leaflet describing nine domestic novelties, in the way of electric irons, kettles, geysers, heat pads, &c.

National Electric Lamp Association, Cleveland, Ohio.—Booklet of data relating to carbon, Gem, tantalum and Mazda lamps.

The Key Engineering Co., Ltd., 4, Queen Victoria Street, E.C.—Pamphlet describing the Key spring conduit for interior wiring, with the latest improvements, fully illustrated. The system was described in our issue of July 8th, 1910.

Messrs. Lassen & Hjort, 52, Queen Victoria Street, E.C.—Card illustrating the Lassen & Hjort patent automatic water softener and purifier.

General Electric Co., Ltd., Queen Victoria Street, E.C.—Card giving particulars and prices of Osram lamps.

Allgemeine Elektricitats Gesellschaft, Friedrich Karl-Ufer, 2-4, Berlin, NW.—Leaflets relating to lighting with low-pressure lamps and transformers, light electric railways for agriculture, safety devices for electric lifts, and small portable measuring instruments.

The Reflector Syndicate, Ltd., 82, Victoria Street, S.W.—Pamphlet describing the Cowper-Coles gold mirrors for motor-car head-lights, searchlights, &c., and the works of the syndicate at Willesden.

Le Carbone, 17, Water Lane, E.C.—Price lists and pamphlets relating to the "Carbi" cells, "Lacombe" central-zinc cell, Boudreaux dynamo brushes and carbon brushes.

Messrs. Krupka & Jacoby, 11, Queen Victoria Street, E.C.—Price list of Dr. Lessing's carbon brushes, for which they are sole agents for the United Kingdom and the Colonies.

Litholite, Ltd., 55, Hackney Grove, N.E.—Reprints of sheets Nos. 2 to 12 for insertion in their catalogue of Litholite insulators, giving dimensions and prices of insulated handles for switches and rheostats, bushes, terminals and washers.

Private Meeting.—Moss Mansell, electrical engineer and contractor, trading as Elliott & Mansell, 12, Soho Street, London, W.—A meeting of the creditors of the above was held on Monday, at the offices of Messrs. Corfield & Cripwell, accountants, Finsbury Pavement, E.C., when a statement of affairs, as at August 5th last, was presented. This showed liabilities amounting to £774 1s. 1d., of which £392 7s. 3d. was due to trade creditors, and £140 to a cash creditor, the balance of £241 13s. 10d. being in respect of debts owing in connection with a cinematograph show. The assets were estimated to produce £503 6s. 5d., less £23 10s. 9d. for the claims of preferential creditors, leaving net assets of £479 15s. 8d., or a deficiency of £294 5s. 5d. It was reported that the debtor started trading in partnership at Tower Street, in 1903, with a Mr. Elliott. At that time the debtor's capital amounted to about £20. In 1905 the business was removed to its present address. The partnership was continued up to May, 1908, when Mr. Elliott retired, receiving a sum of £80 as his share of the business. The debtor had not kept a proper set of books, and, consequently, the usual trading figures could not be presented. The debtor attributed his present position to the heavy expenses he had been put to in connection with the picture show. On behalf of the debtor an offer was made of a composition of 10s. in the £, payable by instalments. The offer was accepted, and Mr. G. Corfield was appointed to act as trustee in the matter. A committee of three of the principal creditors was also elected.

Book Notices.—"British Institute of Social Service; Fifth Annual Report." London: The Institute.

"Sixth Report (1908-9) of the University of Leeds." 1910. Leeds: Jowett & Lowry.

"Il Nuovo Cimento." June, 1910. Pisa: Stabilimento Tipografico Toscano.

Japanese Ironworks.—The Japanese Government are proposing to spend 1½ millions sterling on large extensions to the Imperial Iron and Steel Works at Yokohama. The work will occupy about three years.

Electric Time Service.—The adoption of modern methods of time service appears to be making good progress. The Synchronome Co. inform us that they are installing their system of electrical impulse dials in the following places:—Transvaal Government Offices, Pretoria; Transvaal University, Johannesburg; the Royal Palace at Laeken, Belgium; the Royal Courts of Justice, Rangoon; locomotive workshops and model village for the Manchurian Railway at Shakako; London and South-Western Railway—Engineer's offices, Waterloo; Waterloo South Station and general offices; locomotive and carriage works, Eastleigh, Hants.; Nestlé and Anglo-Swiss Condensed Milk Co., Eastcheap; time ball on dome of Kingsway Hall; the General Accident Assurance Corporation, Aldwych; the Railway Passengers Assurance Co., and Union Bank, Eastcheap; the Hospital for Women, Soho Square, W.C.; Y.M.C.A. Headquarters, Manchester; the Isle and Abbey of Caldey, complete time-circuit throughout the island; the Dundee Technical College, extension of time circuit.

LIGHTING and POWER NOTES.

Ashstead.—The P.C. has accepted the tender of the Leatherhead E.L. Co. to light the village with 54 lamps at £2 17s. 6d. per lamp per annum.

Banbridge.—The Council has intimated to Messrs. Wilkins & Burden, of Dublin, that it will give every facility for an electric lighting scheme, providing a company is formed for that purpose.

Blackpool.—The T.C. has resolved to support the promotion of a Bill enabling local authorities to deal in lamps, fittings, motors, &c., as is proposed by the I.M.E.A.

Bootle.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £8,500 for the purposes of the Corporation's electricity undertaking.

Brentwood.—The U.D.C. has informed Mr. R. O. Whitten, of Warley, that it will not oppose any company coming forward with an E.L. scheme, which the Council will not undertake itself owing to the cost.

Brighouse.—The T.C. has come to a fresh arrangement with the Yorkshire Electric Power Co. for supply in bulk. Hitherto the maximum charge has been 1½d. per unit, and now the charges will be:—To power users connected with the Corporation's existing direct-current system amounting to 67 H.P., a flat rate of ¾d. per unit; for units used in balancing, ¾d. per unit; for all other current, 1½d. per unit. The Council will now supply consumers for power with a consumption of at least 5,000 units per quarter at 1d. per unit.

The Power Co. is extending its mains to Sowerby Bridge, partly in conduits and partly by overhead mains, *via* Brighouse.

Burnley.—At a recent T.C. meeting a member alluded to the disastrous shop fire at Accrington, and remarked that there was some sort of safeguard which could be fixed to hanging wires, especially in shop windows where there was flimsy drapery. He asked if the Electricity Committee had any power to compel the use of such safeguards if they existed; or, if it had no compulsory powers, could it do something in the way of moral suasion when electrical equipments were being passed? The Mayor, who is chairman of the Electricity Committee, could not say whether the Committee had power. At any rate, the moral suasion idea was a good one, and he would see what could be done.

Chatham.—With reference to a proposed increased charge for current by the local company, the Town Council is to obtain an estimate for lighting the whole of the Corporation buildings with gas, and also is to have a report prepared as to the advisability of the Corporation generating its own electricity for lighting the Town Hall.

Continental Notes.—Germany.—Die Oberrheinische Kraftwerke Gesellschaft is the name of a new company which has just been formed in Mulhouse, Alsace, with a capital of £100,000. The new undertaking, which has been organised by the Electrische Licht und Kraft Anlagen Gesellschaft, of Berlin, and the Banque pour Entreprises Electriques, of Zurich, in connection with the municipal authorities of Mulhouse, will take over the existing electric lighting plant in Mulhouse, and will establish other electricity generating plants in Alsace-Lorraine, and in the Grand Duchy of Baden.

Turkey.—The question of the concession for the electric lighting of Constantinople seems to be in an unsettled state. The Technical Commission appointed to go into the matter has been unable to agree, three of the members reporting in favour of the scheme submitted by the Ganz Co., of Buda Pesth; the other two members have, however, prepared a minority report, the tenor of which has not been made public. A second Commission, which inquired into the schemes from a financial and administrative point of view, has also drawn up a report, in which the Ganz project is stated to have been placed last.

Russia.—State Councillor Chatelaine, of the St. Petersburg Polytechnic, has been commissioned to proceed to America to study hydro-electric developments there, in view of the contemplated organisation of Russian water-power schemes.

Saxony.—An innovation in street lighting is said to have been introduced at Jocketa, a village near Plauen, where the public electric lamps are switched off at 11 p.m. For the convenience of some residents who reach home at later hours, "coin switches" have been attached to certain posts, and by inserting the needful coin after 11 p.m., a section of the village is illuminated for a brief period. This is a bright idea, but liable to be expensive to the user, unless, of course, the apparatus automatically rejects sovereigns, latchkeys, &c.

Dewsbury.—The T.C. has decided to support the proposals of the I.M.E.A. for giving powers to local authorities to supply fittings and do wiring work.

Dodworth.—The Barnsley T.C. has decided to erect 15 electric lamps for public lighting at Dodworth.

Dublin.—The E.L. Committee, at Monday's meeting of the Corporation, stated that it was pleased to report that the electricity department had shown satisfactory progress during the past three months. From March 31st to June 30th, 170 new consumers were connected, the number for the corresponding three months of 1909 being 92. During the last fortnight of June the average maximum load on the Pigeonhouse Station plant was 1,702 KW., as compared with 1,425 KW. during the corresponding period of last year. The city electrical engineer laid before the Committee details of an arrangement by which a considerable portion of the South Circular Road work could be postponed; the work which he proposes to carry out being estimated to cost £5,500 instead of the amount of the extensions £11,200, which the Committee had previously arranged for with the approval of the Council. Of the £5,500 a sum of £2,200 approximately was required for the extension of the high-pressure cables from Whitworth Bridge, Usher's Quay, to the Parkgate Street sub-station, with an addition of £950 for the extension of the sub-station, or a total of £3,150. This portion of the work being urgently necessary in order that the duplicate arrangement for the North Circular road work should be completed before next winter, the Committee authorised the city electrical engineer to arrange with the cable contractors to proceed with the work. As soon as the board of the South Dublin Union proceeds with the work of wiring its premises for electric light, the cables will be extended to the area around the union premises, the cost being £2,350. The Committee is pleased to report in this connection that the L.G.B. has acceded to the application from the South Dublin Union for sanction to raise a loan for the installation of electric light, to be used in connection with a supply from the Corporation, and the Lighting Committee believes that the work will be completed before the end of the present year.

Dundee.—Friction has arisen over the recommendation of the Corporation electricity department to support the I.M.E.A. in the steps to secure powers for local authorities to supply fittings, wire consumers' premises, &c. At the T.C. meeting on Thursday last week, a deputation was present from the Associated Electrical Contractors, of Dundee. Mr. Lowden, on behalf of the contractors, argued that if the Council obtained powers to hire out motors and do electric wiring, it would diminish private contractors' business. They denied absolutely the statement of the electricity department that only 10 per cent. of the increase in business was due to the contractors' canvassing, while 90 per cent. was due to the department's canvassers. The combined capital of the contractors was about £50,000, and employed 218 men. Gas and electricity were not on the same footing. So far as heating and cooking were concerned, electricity was a luxury, and, therefore, there was not the same excuse for the Corporation to go in for trading. Mr. Richardson, the city electrical engineer, replying to the deputation, said the various corporations who had not obtained these powers, would very soon be severely handicapped if they did not obtain them. He denied *in toto* that electricity was a luxury nowadays; it was a necessity. It had never been a luxury in the same proportion as gas had been in its earlier days. As to the percentage of new business brought in by private and Corporation canvassers, he admitted there was a slight mistake—the real figures were 92 per cent. brought in by Corporation canvassers, and only 8 per cent. by the contractors' canvassers. He demonstrated this by a specially-prepared diagram, and went on to say that if the Corporation ordered him to drop the present policy of the department, then, of course, he could not be expected to have any responsibility for the success of the department. He held it was decidedly the duty of the department to push its business. From 1904 to 1906 they did not push business, but after that they started to do so, and following their early struggles the business went up with a leap. Then there was a row; the contractors were up in arms. The department slackened off a bit, and for a time they did not have much of an increase. He, however, did not see why he should sit still, and so the department started again pushing business, which soon had an enormous fillip. Mr. Richardson remarked that he was quite willing to have a conference with the contractors, but he must insist that the Council should have these powers quickly. It was difficult to work hand in hand with an Association the members of which were always fighting each other. Convener Don moved approval of the Committee's recommendation. For the life of him he could not see why the contractors opposed it; they seemed to be standing in their own light. The work was left to the contractors, and had been considerable. Lord Provost Urquhart seconded. Mr. Mechan moved disapproval, and said the question was not whether the department was to continue to do canvassing, to which there should be no objection, but that power was to be asked to do the work secured by the canvassers. On a vote the question was remitted for further consideration.

Eastbourne.—The charges for supply are to be reduced from October 1st as follows: When the consumption exceeds 10,000 and does not exceed 30,000 units, ½d. reduction per unit; 30,000 to 50,000 units, ¼d. reduction per unit; over 50,000 units, ½d. reduction per unit; flat-rate consumers, from 5½d. to 5d.; double-tariff consumers, night-rate charge, from 5½d. to 5d.; supply for cooking and heating, 1d. per unit reduction. Where two or more meters are hired by the same consumer in respect of the same premises, the charge for hire of each meter is to be reduced from 10s. to 6s. per annum.

Fleetwood.—A L.G.B. inquiry was held on August 4th into an application by the Fleetwood Council to borrow £4,100 for the purpose of the electricity undertaking. It was stated that under the local Acts the Council's debt was £76,037, and under the Electric Lighting Acts it was £24,164, making a total of £126,016. It was explained that the proposed extensions were requisite, owing to the growing business of the electricity department. The extension comprised a 300-KW. steam dynamo, to cost £1,700; a new switchboard, £560; a new overhead crane, £135; extension of building £1,120, and contingencies.

Greenock.—The Electricity Department earned a net surplus of £3,250 on its last year's working, after placing an extra £1,000 to sinking fund, in accordance with the instructions of the Scottish Office.

Hereford.—The B. of T. has issued an order enabling the T.C. to supply current to residences outside the city area of supply.

The T.C. has received sanction to loans of £2,000 for mains, and £1,500 for services.

Hornsey.—The Council in March last wrote to the North Metropolitan Electrical Power Co., pointing out that it had acted *ultra vires* in supplying a cinematograph theatre in Frobisher Road, and suggesting that an arrangement might be come to as regards this and other "border" cases. An interview subsequently took place, and the Council suggested that as a matter of general principle as regards border cases, the profit made as agreed between the borough electrical engineer and the engineer-in-chief of the company, should be apportioned between the Hornsey and Tottenham areas, according to the rateable values in the respective districts of each of the premises which are supplied, the non-supplying authority receiving a moiety of the profit earned within its own area. The company wrote that it could not agree with this suggestion. The Council at its last meeting had the matter under review, and it was decided to issue instructions for a case to be submitted to counsel for his opinion. The company, in the meantime, is to be informed that the Council is taking steps to protect its rights.

Killeshandra (Co. Cavan).—In connection with the proposed lighting of this town by electricity, the Cavan R.D.C. is proceeding to obtain powers for carrying out the scheme.

Leyton.—The U.D.C. has decided to have the Harrow Green fire station lighted by electricity.

Littlehampton.—The Chichester E.L. and Power Co. has informed the U.D.C. that it intends applying for a prov. order for electric lighting.

Lurgan.—A special meeting of the B. of G. is to be held to discuss a scheme for lighting the workhouse buildings with electricity.

Maidenhead.—The T.C. has reduced the cost of public lighting from £2 19s. 6d. per annum for small lamps to £2 15s.; and from £18 10s. for large arc lamps to £17s. 10s.

Market Harborough.—The B. of T. has intimated that the 1906 electric lighting order is to be revoked.

Newport (Mon.).—A lengthy discussion recently occurred as to the placing of several contracts for plant extension with one firm, it being proposed that Mr. C. P. Sparks, who lately reported on the Council's undertaking, should act with the borough electrical engineer in testing the plant. The chairman of the committee considered the proposal as a vote of censure on the borough electrical engineer, and it was rejected.

Perth.—So satisfactory has the past year been for the Corporation electricity department that a reduction in the price of energy is expected, both to ordinary consumers and the tramway department.

Plymouth.—The electrical engineer having been instructed to report as to the desirability of arranging for the letting of electrical apparatus on hire, informed his Committee that at the present time the Corporation do not possess the requisite statutory powers.

Rosyth.—Work is now advancing more rapidly at the Naval Base, the contractors having been put in a position to restart the whole of their electric cranes and other machinery which were stopped by the recent fire. Three of the four suction gas engines have been replaced, but a fourth is needed to provide a safe working margin.

St. Helens.—The T.C. has decided to support, but only to a limited extent financially, the proposed Bill of the I.M.E.A. seeking powers for local authorities to supply fittings, &c.

The T.C. has decided to erect an additional overhead feeder main for supplying current to the Sutton Heath and Lea Green Collieries Co., Ltd., and the district.

Sheffield.—The Electricity Committee has framed the following conditions with regard to discounts to lighting consumers:—(1) To any consumer who uses electricity for lighting purposes as much as possible throughout the year during daylight or long hours, mostly when the output is not at its maximum, and

provided that the consumption, based on the estimated maximum demand, does not fall below 100 units per annum per 60-watt lamp or equivalent, a discount of 50 per cent. will be allowed from the usual price of 4d. per unit. (2) Accounts will be rendered weekly, monthly or quarterly, at the option of the Committee, and the discounts will be adjusted according to the average daily rate of consumption, as shown between successive readings. (3) No discount will be allowed unless the account is paid before the next account is due. (4) The Committee may, in special cases where it deems it an advantage so to do, make such terms as it thinks fit, provided that in any such case similar terms shall be allowed to other customers in similar circumstances as required by the provisions of the Electric Lighting Act, 1882.

South Africa.—Cape Town.—It is generally understood that satisfaction has resulted from the centralising of electricity supply at the Corporation works, which occurred as the result of shutting down the plants of the docks, railways and post office, and the four public lighting plants. The Government has nearly used its minimum quantity of 1½ million units at 1½d. per unit, during the year, and a considerable saving is understood to have been effected by the arrangement.

Torquay.—Instructions have been given by the T.C. for the preparation of a scheme and estimate for illuminating the Princess Gardens by electricity.

Tunbridge Wells.—The T.C. has decided not to financially support the Bill of the Municipal Electrical Association, as the Council does not at present desire powers to trade in fittings directly with consumers.

U.S.A.—According to a recent issue of the *Electrical World* two additional 14,000 kw. turbo-generator sets have been ordered by the Edison Illuminating Co., of Detroit, for its Delray power house No. 2. The company will shortly increase its supply to the Detroit United Railways to 9,500 kw., and when the Detroit river tunnels of the Michigan Central Railroad are opened next month, a supply will also be given to its rotary equipment.

Plans for improved street lighting in Chicago, adding to the present equipment of 12,000 lamps 10,000 others, the cost of installing which will be financed by the Sanitary District of Chicago, whose hydroelectric generating station on the Drainage Canal near Lockport will supply the energy for operating the entire 22,000 lamps, were discussed recently at the Chicago Electric Club. The city is to pay the district $15 a year for each connected h.p., energy to be taken about 11 hours a night or 4,000 hours a year. The lamp consumption specified is 450 watts. The district will also take over and operate the city's transmission lines and sub-stations, for which it will receive $1 a lamp a year from the city. Maintenance of the distribution circuits and the lamps themselves will be retained by the city electrical department. The estimated saving to the city will be about $27,000 a year for its street lighting.

The army tournament arena at Chicago was illuminated by a temporary installation consisting of flame arcs, 80 at 50-ft. intervals, being provided in the enclosure, suspended from eight 600-ft. spans. Each arc was rated at 3,000 c.p.

The 110,000-volt 30-cycle transmission line of the Grand Falls-Muskegon Power Co., has now been in continuous service since April 30th, 1909. Although working without lightning arresters in a region where lightning storms are severe, the line is reported to give less trouble than neighbouring transmissions of lower pressure.

Walsall.—The T.C. favours the amendment of the Electric Lighting Act proposed by the I.M.E.A., but seeks further information as to the financial support required.

Worthing.—In supporting a proposal to extend an electric light main at the request of a local firm of builders, Alderman Walter, the Chairman of the Electricity Committee of the T.C., remarked that these extensions of mains had so far been the most profitable part of the undertaking. The amount expended on these private extensions up till last March had been £4,600, and the revenue derived from that expenditure last year was £1,922 or 40 per cent. on the outlay. Replying to a question by another Alderman, the Chairman of the Committee stated that they generally found that when builders wired new houses the result was that the occupants used the supply and became permanent customers.

TRAMWAY and RAILWAY NOTES.

Belfast.—At the monthly meeting of the Corporation last week, the proposed tramway extensions in various portions of the city, which have been discussed by the Council in Committee, were approved. The extension scheme, to which we have previously drawn attention, consists of eight different extensions within the city, at a probable cost of £111,000, and the new line of tramway to M'Art's Fort, on the top of the Cave Hill, which, it is estimated, will cost £130,000. This latter scheme includes the provision of artisans' dwellings, which are to be erected under the provisions of the Small Dwellings Acquisition Act, upon ground on the side of the mountain, to be purchased by the Corporation. These dwellings will be let to artisans at 4s. per week, and at the end of 30 years will become the property of the tenant, who will then pay to the Corporation 1s. per week ground rent. The extension schemes were adopted by the City Council, subject to a detailed and complete scheme being prepared and submitted for the Council's approval before the Tramway Committee sought to obtain Parliamentary powers to put the schemes in operation.

Birkenhead.—The linking up of Birkenhead and Wallasey by tramway is projected. The Wallasey Council has been informed that a sub-committee of the Birkenhead Tramways Committee has been appointed to go into the matter, and as the Birkenhead borough engineer has got out his estimates for the scheme, it is most probable that the negotiations will very soon go forward. So far as Birkenhead is concerned, the line of connection will be laid outside the borough boundary, and in any case the carrying out of the scheme will involve a big engineering undertaking. It is understood that Wallasey is well disposed in the matter, as for a number of years the need for better communication between these two Mersey districts has been felt.

Cleckheaton.—The Council has received an intimation from the B. of T. that it has been decided to grant a cessor of powers to the British Electric Traction Co. in respect of the unconstructed portion of the Spen Valley tramways scheme. This means that the projected line connecting Cleckheaton and the upper part of Hightown, Liversedge, will not now be made.

Halifax.—The annual report on the tramways undertaking shows a total revenue amounting to £89,270; working expenses, £53,898, and a gross profit of £35,372—the latter figure comparing with only £26,013 in 1908-9, when the receipts were lower and working expenses over £6,000 higher. From the gross profit is deducted financial charges, and special and Parliamentary charges, leaving a net profit of £13,066, as compared with a loss of a rather larger amount in the previous year. The marked improvement is due to the great drop in special charges for accident compensation, which only amount to £762, as compared with nearly £18,000 in the previous year. The car-mileage during the year was 1,862,068, and the passengers carried 16,323,755, a figure which is not comparable with earlier years owing to the recent substitution of the ticket system for the "fare box." The undertaking covers some 38 miles of route.

Hebburn-on-Tyne.—At a meeting of the U.D.C., on the 8th inst., it was reported that a letter had been received from the Gateshead and District Tramways Co. stating that the question of the extension of its tramway system through Hebburn would be considered at the meeting in September. It was resolved that the clerk should communicate with the Jarrow and Felling Councils with a view to their supporting the action of Hebburn in the matter.

Hull.—The Hull Tramways Department, with its 29½ miles of route, maintains its successful career. The last 12 months' working showed some 35,600,000 passengers carried, nearly 6 millions being ½d. fares and the remainder 1d. ones. The total tramway revenue amounted to £136,985, and after meeting working expenses, a gross profit of £50,887 remained. This, after meeting financial charges, income-tax, &c., was reduced to £22,942, an amount from which £16,000 was reserved for relief of the 1910-11 borough rate, and the balance carried to the reserve fund, totalling now some £106,000. The tramways generating station supplied 4,454,524 units to the line, with a works cost of ·53d. per unit. The power expenses worked out at ·69d. per car-mile, or, with financial charges on a capital outlay of £62,000 added, to ·92d. per car-mile, and the car-miles amounted to 3,655,542. The average traffic revenue amounted to 8·90d. and the working expenses to 5·8d. per car-mile. The Corporation works a short motor-omnibus route, 1½ miles in length, apparently with disastrous results financially. Some 53,000 'bus-miles were run, carrying 347,223 passengers, earning, say, 6d. per mile; the working expenses are given as 15·31d. per mile, and adding financial charges, this total reaches 17·28d. per 'bus-mile. The deficit on this service, which has been in operation since July, 1909, amounts to £2,496, which has been transferred to the reserve fund. The analysis of working expenditure of these 'buses shows that traffic expenses (wages, cleaning, &c.) amount to 4·21d. per mile; general expenses to ·12d. per mile; general repairs and maintenance to 10·98d. per mile (including chassis, gearing, &c., 2·17d.; engine, 1·70d.; body fittings, ·58d.; wheels and tires, 2·89d.; ignition, ·52d.; petrol, 2·24d. per mile, as the principal items). The Corporation owns six omnibuses, and has borrowed £2,674 on this account on a five-year loan.

Llanelly.—The B. of T. has confirmed the order made by the Light Railway Commissioners, reviving the powers granted and extending the periods limited by the Llanelly and District Light Railway Order, 1907.

Lowestoft.—At a meeting of the T.C., on Tuesday, the Tramways Committee reported that the question of running electric cars to Kessingland had been considered. The general manager submitted reports upon four schemes of traction, but the Committee decided that the matter should be postponed for the present.

Manchester.—The possibility of electrifying the Manchester South Junction and Altrincham Railway was mentioned at the half-yearly meeting of the Great Central Railway Co., at Manchester, on the 5th inst. One of the proprietors, called attention to what he termed the very unsatisfactory state of the Manchester South Junction and Altrincham Railway trains. The Chairman (Sir Alexander Henderson) said there was some justice in what had been said. That was a joint line belonging to the London and North-Western Co. and the Great Central Co. in equal proportions, and for some time they had been

considering whether it would be advisable to electrify the line. They had not quite decided what to do, but in view of the possibility of a change in the mode of traction it would be unwise to expend money on new carriages. The proprietors knew, perhaps, of the success which had attended the efforts of the Brighton line to get back traffic of which they had been robbed by the tramways, and it might be that other companies would follow suit.

A Lancashire correspondent writes as follows regarding a scheme for electrifying the Manchester suburban railways:—"The London and North-Western has already decided to give a trial to motor trains on the line between Manchester and Wilmslow, and much will depend on the success of this venture. Investigations show the necessity of a much more frequent and effective train service if the suburban traffic is not to be monopolised by the tramways. The scheme, it is understood, covers at present the areas of Heaton Park, Prestwich, Whitefield and Bury, the extensive district between Stockport and Wilmslow, and the whole of the southern side of Manchester. If the scheme matures there will probably be a 10 minutes' service of electric trains in the mornings and evenings between the city and Manchester suburbs, and it is thought that this would do much to attract back to the railways the traffic which in recent years has largely been secured by the tramways."

South Lancashire.—At a meeting of the Bolton T.C. held on the 3rd inst., Alderman Miles, chairman of the Tramways Committee, said he thought through running with the South Lancashire Tramways Co. was a success, and it had certainly proved a great convenience to the public. He had had an interview with the Hon. Arthur Stanley, chairman of the South Lancashire Co., and he had expressed the hope that they would continue the through running.

Stalybridge.—At the request of a number of ratepayers, the T.C. recommended the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways Board to run a line down Market Street—the chief thoroughfare of the town—but the Board, upon receiving the estimate of its engineer as to the cost of construction, has decided not to proceed with the project.

Stockport.—Out of the profits made during the past year, the tramways department has contributed a sum of £5,000 towards the relief of the rates.

Tarporley.—Notice of intention to revive the Tarporley Light Railway Order has been received by the Cheshire C.C.

U.S.A.—Further tests of the Edison battery car used on a cross-town route in New York have been published. The route is 4·7 miles long and has 46 curves and a 3·5 per cent. grade 1,000 ft. long; the car weighs, empty, 10,000 lb., and with an average load, 12,400 lb.; its equipment consists of two 5-H.P. 110-volt motors and 100 A-8 Edison cells for traction. During the three months of the test the car was on the road 1,132·5 hours and covered 5,152·5 miles, which was an average of 57·25 miles per day of 12 hours 35 min. The battery is charged once a day, the charge lasting 4·4 hours and taking place at 185 volts and 60 amperes. The total daily energy input to the battery is 48,840 watt-hours, and the battery output measured at the motor brushes is 30,280, giving an energy efficiency of 62 per cent. Reducing the total energy consumption to a unit basis, the gross energy input to the battery for this service was 137 watt-hours per ton-mile, and based on motor consumption, 85 watt-hours per ton-mile, the schedule speed being 4·77 miles per hour with eight stops per mile and an average running speed of 5·74 miles per hour. Up to the present date the car has run more than 10,000 miles on the worst kind of track and in all kinds of weather. During this period there have been no repairs to the car or battery except the renewal of one motor brush and the addition of 70 gallons of water to the battery.

TELEGRAPH and TELEPHONE NOTES.

Automatic Telephony.—Four exchanges for a new automatic telephone system for the central business district of Chicago are about to be erected.—*Electrical World.*

Japan.—It is reported that the Japanese Department of Communications has decided that the existing system of telegraph and telephone wires shall be converted into an underground one.

Telephoning to Trains.—It is stated that the Brighton Railway Co. will install the Kramer system of telephoning to or from a moving train on the "Southern Belle" express between London and Brighton next December.

Underground Cables.—The Post Office underground cable system has been completed from London to Newcastle *viâ* Leeds. The cost averages £1,500 per mile.

Wireless Telegraphy.—It is reported that as soon as the Commonwealth Government installs wireless stations around the Australian coast, the P. & O. and German mail steamers, the Aberdeen, White Star, Orient and Union lines will be equipped with wireless apparatus. Some difficulty has arisen over the selection of a site for the wireless station at Sydney, as the contractors wish to erect it on the coast, and the Defence Department insists on its being 7 miles inland, so as to be secure from attack from the sea in time of war.

The fact that the Telefunken system has been adopted for the Government long-range stations, and that the agents controlling it in Australia are connected with influential daily and weekly papers, has aroused some fears that a "corner" in wireless may be effected.

An American Consul states that a contract has been signed between the Lloyd Brazileiro, the subsidised line of steamships serving Brazilian ports and maintaining a service between Brazilian ports and New York, and the United Wireless Telegraph Co., of New York, for wireless telegraph stations upon 21 ships of the Lloyd line and eight stations along the Brazilian coast. The system will afford communication between Rio de Janeiro and all the Lloyd fleet all the time, except the New York service when ships are out of range.

The R.M.S. *Makura* is said to have created a record for the Pacific by speaking North Vancouver at a distance of 2,080 miles.

A Poulsen wireless telegraph station is being erected at San Francisco, and will be followed by others at Los Angeles and Portland. The American Poulsen Co., according to the *Electrical World*, intends to establish 480 stations for communication over land and sea.

According to the *Standard*, about 521 naval vessels are equipped with wireless stations, of which 176 are British, 140 French, and 93 German, no other country having more than 27 (except the United States, for which data are wanting). Great Britain has 113 stations on merchant ships, and Germany 67, out of 260. Some 350 ships are equipped with the Marconi system.

A proposition has been put forward that the cable companies should erect wireless stations at their cable stations on the route to India, for communication with vessels.

Experiments have been carried out by Baron von Lepel in communication by his system between Slough and Paris and Brussels. The system is worked by the Anglo-German Wireless Syndicate.

The City of Dublin Steam Packet Co. is fitting its mail packets with Marconi wireless telegraphy.

"Wireless" in Chicago.—At this time, there are estimated to be not less than 800 amateur wireless telegraph stations in Chicago. This figure, which has been made on a conservative basis, includes the total present number of active, dormant and neglected outfits in which the interest of their generally youthful owners is at various degrees of intensity. It numbers equipments ranging from the ½-in. spark coils of beginners up to the high-powered stations of advanced amateurs, which are in all respects equivalent to the commercial outfits. In addition to the amateurs, there are three wireless telegraph companies having stations in Chicago—the United Wireless Telegraph Co., the Great Lakes Radio-Wireless Co. and the Continental Consolidated Wireless Co. The first-named concern does a commercial business with its chain of wireless stations on the shore of the Great Lakes and with 65 vessels equipped with its apparatus.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—August 16th. Bare hard-drawn copper cables (3 tons 2 cwt.) for the Corporation of Melbourne. See "Official Notices" August 5th.

August 23rd.—4,840 yards single-conductor lead-covered cable (460 volts), and 880 yards concentric lead-covered cable (2,000 volts), for the Corporation of Melbourne. See "Official Notices" August 5th.

August 30th.—Telegraph and telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" July 29th.

September 7th.—Battery material and glassware for the P.M.G.'s Department in Queensland. See "Official Notices" July 22nd.

September 20th.—Telegraph and telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" August 5th.

September 27th.—Electric lamps for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

October 4th.—Telegraph and telephone material for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

October 4th.—Telegraph and telephone insulators for the P.M.G.'s Department in all States. See "Official Notices" to-day.

Austria-Hungary.—Tenders are invited until October 1st, for an electric supply installation for the town of Mostor.

Belgium.—September 11th. Tenders will be received at the "Direction Générale des Ponts et Chaussées, rue de Louvain, 38, Brussels," up to September 11th, for the supply and installation on the tidal quay at Ostend of four electric travelling cranes. For further particulars see this column in last week's issue.

The municipal authorities of Hollogne-aux-Pierres (province of Liége) are inviting tenders until the 27th inst. for the establishment of a central electric lighting station in the town.

Canada.—Winnipeg.—September 1st. Manufacture, delivery and installation of 46,000 ft., 13,000-volt three-core cable; specifications from Power Engineer's Office, Winnipeg; tenders to M. Paterson, Secretary, Board of Control. The specification and conditions may be seen by British makers at the Commercial Intelligence Branch of the Board of Trade.

Chelmsford. — August 31st. Supplying and fixing wiring for lighting Trinity Road Schools by electricity, with alternative tenders for gas lighting, for the T.C. W. H. Pertwee, architect, The Institute, London Road, Chelmsford.

Dublin.—August 24th. Wiring and fittings for electric lighting of the workhouse, James's Street, for the South Dublin Union. See "Official Notices" August 5th.

Egypt.—October 20th. Electrical installation and refrigerating plant, for asylum at Khanka. Specification from Chief of Administrative Service, Public Works Department, Cairo; for particulars as to tendering see *Board of Trade Journal*.

France.—November 1st. The Prefect of the Department of the Yonne, at Auxerre, is inviting offers for the construction of a system of metre-gauge electric or steam railways in the Department, the aggregate length of the proposed lines being about 233 kilometres.

Ipswich.—August 22nd. Underground cables, for the Corporation Electricity Department. See "Official Notices" to-day.

Kirkcaldy.—The Corporation invites tenders for work and material required in the extension of tramways to Dysart. Particulars from O. F. Francis, burgh electrical engineer.

Lancaster.—Six 25-H.P. shunt-wound motors, with starting switches, for Messrs. Waring & Gillow, Ltd. See "Official Notices" to-day.

London.—L.C.C.—August 30th. Wiring and fitting for electric lighting of the second section of the Woolwich Road car depôt. See "Official Notices" July 22nd.

August 30th.—Covering cables with asbestos tape. See "Official Notices" August 5th.

HACKNEY.—September 15th. Extension of the main switchboard, for the Borough Electricity Department. See "Official Notices" to-day.

Newport.—August 15th. Carbon-filament lamps, radiator lamps, flame arc carbons, and alternating and direct-current two-rate and prepayment meters, for the Electricity and Tramways Committee. See "Official Notices" July 22nd.

New Zealand.—December 15th. Installations of wireless telegraphy at Doubtless Bay, Gisborne, Cape Farewell, Sumner and Bluff. See "Official Notices" August 5th.

Oldham. — August 17th. Construction of tramway (except electrical equipment), Ripponden Road, for the T.C. Borough Surveyor. (Returnable deposit of £1 1s.)

Rainhill.—August 25th. Telephone apparatus and cable at the County Asylum, for the Lancashire Asylums Board. See 'Official Notices" August 5th.

Rawtenstall.—The Council has decided to ask for tenders for six new one-deck saloon cars to carry 26 passengers and to have a smoking compartment at each end.

Salford.—August 15th. 500 tons of steel tramway rails, for the T.C. General Manager, 32, Blackfriars Street.

Spain.—August 16th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the establishment and working of a telephone line in the Linares district.

Tenders have lately been invited by the municipal authorities of Malagon (Province of Alicante) for the concession for the electric lighting of the town during a period of six years.

CLOSED.

Australia.—SYDNEY.—According to the *Australian Mining Standard*, the tender of the Australian General Electric Co. of £9,135 for the supply of switchboards and transformers at the Council's electric power house, and the tenders of Messrs. Noyes Bros., British Insulated and Helsby Cables, Ltd., and Mr. Jas. Connolly, for other electric lighting materials, are recommended.

Bury.—The Corporation has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for the supply of E.H.T. trunk mains to be laid from the new power station to the present electricity works.

Cardiff.—A contract for electric light installation at the new Welsh Calvinistic Methodist Church and Schools has been secured by Messrs. A. G. Arnold & Son, Newport, Mon.

Denmark.—The Allmänna Svenska Elektriska Co. has closed a contract with the Corporation of Odense, Denmark, for the building of an electric tramway in that town.

Eccles.—The T.C. has accepted the tender of Messrs. E. M. Evans & Sons, Manchester, for the electrical wiring and fittings for the proposed new secondary school, at £461.

Edinburgh.—Messrs. A. W. Penrose & Co., Ltd., of 109, Farringdon Road, E.C., have secured the contract for the electric lifts required in the new head post office at Edinburgh, the contract amounting in all to about £4,000. This is in addition to the following work which they already have in hand for the Post Office:—Three 30-cwt. goods lifts for the new Western District Post Office; three alternating-current lifts, Sheffield; one passenger lift, Leeds; one passenger lift, Newcastle-on-Tyne.

Farnham.—The Farnham Asylums Committee of the Southampton C.C. has accepted the tender of Messrs. Shalders and Davis, Southampton, for electrical machinery, at £1,715.

Folkestone.—The T.C. has accepted the tender of Mr. E. Morgan, at £69 15s., for supplying and fixing electric fittings at the Corporation offices.

France.—The French Post and Telegraph authorities in Paris have just placed contracts as follows:—La Société des Trefileries de Fourchambault, of Fourchambault (Nievre) 505 tons of galvanised wire, and 100 tons of iron wire, 3 mm. dia., and 100 tons ditto, 4 mm. dia. La Société des Trefileries de Creil, of Creil (Oise), 100 tons ditto 4 mm. dia.; Les Forges et Acieries de Commercy, of Commercy (Meuse), 100 tons ditto; and Messrs. Madcellot & Co., of Turville (Haute Marne), 100 tons ditto.

Germany.—The municipal authorities of Berlin have placed the contract for the electrical equipment of their second central generating station at Lichtenberg with the Siemens-Schuckertwerke Gesellschaft.

Hamilton.—Mr. William Torrance, electrical engineer, Hamilton, has been successful in securing the electric lighting and wiring contract in connection with the erection of the new Hamilton Academy. The contract price exceeds £1,500.

Manchester.—The City Council has accepted the tender of the Union Cable Co., of Berlin, for service cables, at £1,500. At the meeting on August 3rd objection was raised to the order going to a foreign firm, but the chairman of the Electricity Committee said the lowest British tender was £2,750, and there was no doubt that a cable ring existed in England. An amendment to refer the matter back to the Committee was negatived.

Motherwell.—The Council has accepted the offer by Messrs. Chamberlain & Hookham, Ltd., Birmingham, for meters. Acceptance of the following offers was also recommended. For cooling tower—Messrs. Balcke & Co., London, £818. For Cable—Callender's Cable & Construction Co., Ltd., London, £530. For switchboard extension—Siemens Bros. Dynamo Works, London, £305.

Rawtenstall.—The Electricity and Tramways Committee has decided to let the contract for the overhead equipment including standard poles and wiring in connection with the tramway extension up the Whitewell Valley to Messrs. Clough, Smith & Co., and for the cables to Messrs. Glover & Co.

Salford.—The T.C. has accepted the following tenders:—

Messrs. Lightfoot Bros., Manchester.—Telephonic installation at the Sanatorium, £28.
British United Road Traction Co., Ltd., Manchester.—28 to 31 H.P. Halley petrol tower wagon, £670.
Messrs. T. Robinson & Son, Ltd., Rochdale.—Moulding machine, £36, and grinding machine, £20.
Messrs. C. Churchill & Co., Ltd., Manchester.—Lathe, £58.
Selson Engineering Co., Ltd., London.—Shaping machine, £68.

Sheffield.—The T.C. has accepted the following tenders:—British Insulated and Helsby Cables, Ltd., two miles of figure-8 bronze trolley wire, 8¼d. per pound, less 2½ per cent.; Messrs. W. T. Glover & Co. Ltd., 10 tons of H.C. copper wire, to be made up into cables during a period of two years; Messrs. Gilbert Heathcote & Co., constructional steel work for extensions to boiler house, Neepsend generating station, £6,355.

Stockport.— The T.C. on August 3rd accepted the following tenders for supplies to the electricity and tramway works:—

Morgan Crucible Co.—Carbon brushes.
British Insulated and Helsby Cables, Ltd.—Overhead line materials.
Mr. T. Richardson.—Slipper blocks.
Henry Hollingdrake & Son.—Nuts, bolts and ironmongery.

Swansea.—The Harbour Trustees have accepted the tender of Messrs. C. & A. Musker (1901), for the supply of three electric transporters for the sum of £4,100. The transporters are intended for the new King's dock.

Walsall.—The T.C. has accepted the following tenders:—Messrs. H. G. Richardson & Co., providing low-tension switchboard and altering a switchboard, £88 10s.; the Union Electric Co., Ltd., three high-tension isolation switches, £19 10s.

West Bromwich.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for cables for a year.

Wolverhampton. — The Electricity Committee has accepted the tender of Messrs. Batley, Pegg & Co., Ltd., for the supply of 1,000 cast-iron socket pipes.

NOTES.

Electrical Dehydration of Oil.—According to the *Journal of Electricity, Power and Gas*, an electrical process for treating the waste oil pools in California, which are at present valueless owing to the large proportion of water which the oil contains, has been patented by Dr. E. G. Cottrell, Professor of Physical Chemistry at California University. The process is said to treat the oil mixture at a cost of about 1 cent per barrel. The material to be treated is an intricate mechanical mixture of oil and water; subjecting this to the influence of a H.T. alternating current results in the minute water particles agglomerating and sinking. The treating apparatus is essentially a huge Leyden jar whose disruptive discharge penetrates the oil film and allows the water particles to run together. This phenomenon was observed in a high-power microscope, and is probably the best explanation of what actually takes place. In practice an alternating current is stepped up through a transformer to about 10,000 volts. The oil is delivered to the treater and passed on to the storage tanks, the precipitated water being carried off at the bottom. A plant has been in use with a capacity of 500 barrels per day, and in a five months' run treated waste oil, gaining therefrom 75,000 barrels of marketable oil. This oil formerly contained 14 per cent. of water, which was reduced to less than 2 per cent. A plant is also being installed in the Santa Maria fields at one of the wells of the Pacific Coast Oil Co. This handles 1,000 barrels daily of oil containing about 25 per cent. of water. Experiments show that it requires about one-seventh of a KW.-hr. per barrel of oil treated. It is expected further to reduce this consumption by the use of a rotating electrode.

Radium in Australia.—It is reported that Mr. Niemann, Government chemist at Pine Creek, claims to have discovered the existence of radium, possibly in large quantities, in the Northern Territory.

Overhead Wires and Aviation.—The rapid progress that has recently been made in aviation, especially in France, would seem to be bringing forward some new problems for electrical engineers to solve. For example, the French National Aerial League has just drawn the attention of the French Minister of Public Works to the increasing number of cross-country flights by aeroplanes, and urges that consequently measures should be introduced requiring all electric transmission lines to be provided with signals to warn aviators of their approaching the same when descending from a flight.

Copper.—Messrs. Merton's circular for July 30th shows further decrease in the visible supplies, which have fallen from 103,957 tons (end of June) to 99,239, a reduction of 4,718 tons. The reduction since the end of February has been 14,216 tons, or at the rate of 2,843 tons per month. The withdrawals during July have been principally from English ports (2,646 tons), France dropping 74 tons, and the rest being reduction of quantities afloat. The detailed returns show higher figures for the States and Spain, average for Chile and Australia. The deliveries at 45,027 tons is considerably the highest figure for the past two years, and accounts for the hardening in the price.

Parliamentary.—On August 3rd the Royal Assent was given to the following Acts:—Electric Lighting Orders Confirmation Acts, Nos. 1, 2 and 4; Tramways Orders Confirmation Act; Metropolitan District Railway Act; London United Tramways Act, and the London County Council (Tramways and Improvements) Act, 1910.

British Metal-Filament Lamps.—Referring to the claim of "Metalite, Ltd." to be the only British manufacturers of metal-filaments in any considerable quantities, the solicitors to the "Z" Electric Manufacturing Co., Ltd., have written to the Press pointing out that their clients have been manufacturing and selling British-made metallic-filaments and lamps for some years, and claiming for them the premier position. They point out also that recently the company obtained judgment in the High Court upholding one of their most important patents and granting damages, with an injunction restraining the importation of lamps infringing this patent.

The Edison and Swan United Electric Light Co., Ltd., have also written stating that they have for a long time been manufacturing metallic-filaments and lamps at their Ponder's End and Newcastle works in very considerable quantities.

The British Association.—The *Times* of Friday last published a forecast of the forthcoming meeting of the British Association at Sheffield, which opens on August 31st. On the evening of that day the retiring president, Sir J. J. Thomson, will introduce his successor, Canon T. G. Bonney, who will deliver his inaugural address. Among the papers of electrical interest are the following:—"Atmospheric Electricity," by Dr. Chree (Section A); address by Prof. Dalby, President of Section G; "The Laws of Electromechanics," by Prof. S. P. Thompson; "Accelerometers," by H. S. Wimperis; "The Electrification of the Brighton Railway," by Philip Dawson; "Heat Insulation," by F. Bacon; and a joint discussion on combustion with Section B. An admirable programme of receptions, garden parties, visits to works, and excursions in the neighbourhood has been arranged, and we have no doubt that the visit to the city of steel will prove both instructive and enjoyable.

It has been proposed that the Australian Government shall invite the Association to meet in Australia in 1913 or 1914.

Storage Battery with Porous Partitions.—In a recent issue of the *Electrical World* a battery is described which is provided with porous porcelain plates to keep the paste in position in the leaden grids. The porous plates are small and corrugated, and are securely attached to the grids.

Engineering and Machinery Exhibition.—This Exhibition will be opened on September 1st, at Olympia, and will remain open until September 26th.

The Metric System.—In a leading article the *Electrical World* recently drew attention to the isolation of the English-speaking peoples amongst the civilised nations of the world, in their retention of "an archaic medley of weights and measures," and urged the necessity of action to bring about the reform that is so greatly needed. Such action has been taken by the American Electrochemical Society, which has decided that all papers read before it and containing English measures must have the corresponding metric values inserted immediately thereafter in parentheses. The same rule has been adopted by the Illuminating Engineering Society, and it is understood that the American Institute of Electrical Engineers will follow suit in the course of the next six months. It is believed that this practice will render the *Proceedings* of these societies of interest and utility to foreign engineers, and we cordially second our contemporary's suggestion that all engineers and engineering societies should adopt it also. We note that on August 4th the House of Representatives of the Australian Commonwealth passed a resolution, with only two dissentients, approving the adoption of the "decimal" system—by which, no doubt, the metric system is meant—in Australia, and agreed that the adoption of the system throughout the Empire should be put forward for approval at the next Imperial Conference. If this country delays much longer it will be in danger of finding itself alone in clinging to a chaotic code (to call it a system would be a contradiction in terms) abandoned by all its rivals, as a clog upon progress and a source of continual waste of physical and mental labour.

Educational.—Glasgow and West of Scotland Technical College.—The day classes begin on September 27th, and the evening classes on September 22nd. The Diploma of the College is granted in civil, mechanical and electrical engineering, &c., and leads up to the B.Sc. degree of Glasgow University. New engineering laboratories have recently been built and equipped. Particulars are given in our advertisement pages to-day.

Diesel Plant at Saltburn.—The Saltburn electricity works of the Cleveland Trust, Ltd., were first started with a gas plant equipment, but the results were not in any way those which were anticipated. This plant was superseded by a steam-engine plant, which, while giving every satisfaction when considered from the points of view of reliability and continuity of supply, "had fuel costs so high that it was exceedingly difficult to make the concern a payable proposition, this being, unfortunately, the position of many small steam-driven power stations in various parts of the United Kingdom." It was accordingly decided to install an internal combustion engine of the Diesel type, supplied by the Diesel Engine Co., Ltd. We give some particulars from an official report on this case which may be of general interest:—

The fuel costs, with the suction gas plant, were never below "0·5d. per unit generated, and with the steam plant the lowest figure was 0·6d. per unit generated." This latter figure, although a good one for a small steam plant, is considerably higher than the guarantee given with the Diesel plant of 0·685 lb. of fuel oil per unit generated, and a contract for fuel oil delivered at Saltburn at the rate of 47s. per ton in 10-ton tank wagons, free on rail alongside works, has been entered into. It will be seen, therefore, that "the fuel costs in this power station will be 0·172d. per unit generated." It is estimated that "83,500 units will be generated during the coming year, the total fuel bill being the very small sum of £59 16s. 10d." In many small stations it is almost impossible to produce a balance-sheet showing a profit, and in nearly every case this is due to the fact that the cost of the stand-by losses on the steam-raising plant amount to more than the cost of actually generating the energy required.

Mining Exhibition.—A private exhibition of colliery and mining specialities, signalling systems and telephones, motors, cables, &c., is being held from August 8th to 27th, at the Park Hotel, Cardiff, and from August 31st to September 10th, at the Metropole, Swansea, by the Adnil Electric Co., Ltd., of Adnil Building, Artillery Lane, E.C.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Hereford T.C. has increased the salary of Mr. Watson, charge engineer, from 35s. to 45s. per week.

The Finchley District Council has increased the salary of Mr. E. Calvert, electrical engineer, from £500 to £525 per annum.

The West Bromwich T.C. has increased the salary of Mr. W. W. Alston, assistant electrical engineer, from £140 to £150 per annum, which is to be the maximum.

General.—MR. P. M. HAMPSHIRE has been appointed lecturer and instructor in engineering subjects at the Municipal Institute, Walsall, at a salary of £160 per annum.

The marriage took place at Erith on July 28th, of MR. ERNEST EDWARD JUDGE, assistant works manager at Gravesend for Messrs. W. T. Henley's Telegraph Works Co., Ltd., and Miss E. G. Clark, second daughter of Mr. C. Clark, of Northumberland Heath.

MR. J. W. SAALER, who has been in charge of the Manchester branch of Messrs. Bruce Peebles & Co., Ltd., has left for South Africa to take up an important position for the firm at Johannesburg. He is succeeded at Manchester by MR. H. B. TILLEY.

Tramway Officials.—MR. E. P. LISTER, of Blackpool, has been appointed chief clerk of the tramways by Colchester T.C., succeeding MR. W. J. MCDONALD, who has been appointed traffic superintendent of the Burton and Ashby Light Railway.

The employés of the Mansfield Tramways Co., Ltd., have presented a polished oak smokers' cabinet to MR. T. G. GREGORY, who has severed his connection with the company.

Obituary.—On Sunday last Annie Matilde, the wife of MR. H. F. PARSHALL, died suddenly, at an early age. We offer our sincere condolences to Mr. Parshall.

The death occurred on July 31st, after an operation, of MR. W. B. SISLING, one of the managing directors, and formerly secretary of Messrs. Laurence, Scott & Co., Ltd., Norwich. He was 50 years of age, and had been connected with the company from its inception in the early eighties. He has left a large number of friends, including ourselves, all of whom formed a high opinion not only of his business ability and integrity, but also of his technical knowledge.

CITY NOTES.

Metropolitan District Railway Co.

THE report of the directors for the half-year ended June 30th, 1910, states that the expenditure on capital account during the half-year has been £51,673. The gross receipts have amounted to £300,046, being an increase of £26,727 on the receipts for the corresponding half of last year. The working expenses have amounted to £143,331, being a decrease of £4,765. Commencing March 1st, 1910, the company inaugurated a through service of trains to Uxbridge under the provisions of the Harrow and Uxbridge Railway Act, 1899. After providing for interest and other charges, and setting aside £10,000 as a reserve for renewals, the net revenue account shows a credit balance of £62,277, and the directors recommend that a dividend at the rate of £4 per cent. per annum be declared on the 4 per cent. guaranteed stock, and that a dividend at the rate of £3 per cent. per annum be declared on the 4½ per cent. first preference stock. The following table gives a summary of comparative figures for the first halves of the years 1910 and 1909 :—

	Half-year ended June 30th, 1910.	Half-year ended June 30th, 1909.
Gross revenue	£300,046	£273,319
Working expenditure	143,331	148,096
Passengers, including workmen and season-ticket holders' journeys	36,180,308	32,949,895
Passengers carried at workmen's fares	6,646,532	6,005,454
Passenger receipts	£280,483	£254,020
Average receipt per passenger	1·86d.	1·85d.
Train-mileage on District Railway	1,666,350	1,557,559
Car-mileage on District Railway	6,646,998	6,201,738

The Bill which was approved by the proprietors at the meeting in February last, has now become law, having received the Royal Assent on August 3rd. Under the provisions of the Metropolitan District Railway Act, 1910, the holders of the 4 per cent. guaranteed stock, in lieu of their extinguished claims for dividend arrears, are entitled to receive in respect of each £100 of such stock (1) £14 15s. 4 per cent. guaranteed stock fully paid (subject to income-tax); (2) four warrants of 10s. each (subject to deduction of income-tax), payable respectively on August 15th, 1910, February 15th, 1911, August 15th, 1911, and February 15th, 1912. These warrants will be issued along with the warrant for the dividend for the past half-year, and the certificates for the additional stock as soon as practicable. Income-tax deduction in respect of the stock to be issued will be made in stock. The Act of 1910 confirms the agreement with the London and South-Western Railway Co. providing for widening the railway so as to give the District Co. the exclusive use of two tracks between Turnham Green and Ravenscourt Park, which was approved by the proprietors at the meeting in February last, and the work has been commenced. The Bill promoted by the Charing Cross, Euston and Hampstead Railway Co. for extending their railway to a point under this company's Charing Cross Station, failed to pass through Committee in the House of Lords. The Bill for power to construct a railway between Wimbledon and Sutton has passed through Parliament, and contains clauses giving this company running powers over the proposed railway. The directors regret the retirement of Mr. James R. Chapman from the board in April last; Mr. Albert H. Stanley, general manager of the company, since September, 1907, was elected a director to fill the vacancy. Sir George Gibb resigned his office as managing director on his appointment in May last to the position of chairman of the Road Board, and Mr. Albert H. Stanley was then appointed managing director. Mr. Joseph Carter, secretary of the company since January, 1905, was, at the same time, appointed assistant to the managing director, and Mr. W. E. Mandelick was appointed secretary. The Right Hon. Lord George Hamilton, P.C., has consented to act as chairman of the company.

Sir George Gibb presided on Wednesday over the half-yearly meeting held at the Westminster Palace Hotel, Victoria Street, S.W.

The CHAIRMAN, in moving the adoption of the above report, said it gave him great pleasure to be able on that, the last occasion on which he would address them from that chair, to submit accounts which were so satisfactory as those now before them. They had had a record year both in traffic and in revenue. They had carried 36 million passengers, or an increase of 3¼ millions, and the passenger receipts amounted to £280,000, an increase of £26,000, which was equal to an advance of 10 per cent. The average receipt per passenger was 1·86d. The season ticket revenue continued to show a good increase—£8,389, equal to 29½ per cent. The increase in traffic was general throughout the whole system—at practically all the stations, with the exception of a few on the eastern side of the City. There was a decrease in the working expenses of 3¼ per cent.—the main item being a reduction of £5,300 in car repairs. They need, however, attach no special significance to that figure, as it was due to a special expenditure on account of the converting of the hand-working doors to the pneumatic principle in the corresponding half of 1909. Train charges also showed a decrease, which was mainly due to the large saving which had been effected in the cost of electric current. They had effected a saving in that item of no less than 23 per cent., as compared with the corresponding period last year. Two important factors had contributed to that result. The shareholders would remember that at the last meeting he mentioned they were making arrangements for altering the scheme in regard to the depreciation fund. Under an arrangement with the Power House debenture-holders they had to place a sum calculated on a 2½ per cent. basis on the total capital expenditure, whether it was spent on machinery, land or buildings, to depreciation. He thought that was a wise and prudent arrangement to begin with, but now that the depreciation account had amounted to £148,000, it was plain that the sum set aside was substantially in excess of any reasonable calculations for depreciation. Therefore, they had arranged, with the sanction of the trustees of the Power House debentures, that the sum set aside should be £20,000 per annum, instead of a varying amount somewhere in the neighbourhood of £35,000. Another factor—and, perhaps, the main factor—was that they had got rid of the unsatisfactory steam turbines which were originally installed, and now had Parsons steam turbines, which were giving most satisfactory results. The cost of coal had not contributed to the saving, because during the past half-year the average price of that article had been slightly higher than in the corresponding period of 1909. Against the saving he had mentioned, they had got to set the increase in consumption of current due to the greater car-mileage, and the total result was a net decrease in the train working of £1,500, and in working expenses a net reduction of £4,765. They had, as in former years, set aside to renewals and contingencies, £10,000, and, after carefully looking into the matter, they thought that a reserve of £20,000 a year for renewals and contingencies was proper and adequate. The Bill promoted by the company received the Royal Assent on August 3rd, and they could not issue their accounts till then, as they were based on the provisions of that measure. The scheme for dealing with the arrears of dividend on the guaranteed stock was sanctioned by Parliament, and consequently that item in the balance-sheet now disappeared. They were all aware that the scheme involved an increase in the guaranteed stock, which would require £7,500 per annum, and four warrants had to be met for the next 3½ years, amounting to £6,250 each. The position of the company was such that the payment of those warrants and of the full dividend on the guaranteed stock might be regarded as absolutely sure. The general outcome of the half-year's working was very satisfactory. The guaranteed stock received its full dividend; the first preference stock got 3½ per cent.; and £8,527 was carried forward to the next half-year. He confessed the results were somewhat better than he anticipated. They had a very good half-year in June, 1909—the increase in the amount available for dividend in that half-year was £28,000, which, with the £10,000 placed to reserve, amounted to £38,000. Last December the results, although good, were not quite so good, and the smaller percentage of increase per passenger in that half-year made them cautious in estimating the results for the half-year under review. He was glad, however, that the results had exceeded their expectations. He had dealt somewhat quickly with the past half-year's work, and it would, perhaps, be interesting if he gave them a short survey of the company over a longer period. Naturally, he looked at the time during which he had been connected with the company. When he became its chairman 4½ years ago, the company's darkest days were just beginning. In June, 1906, the passenger revenue was down to £204,000, although only a few years before it had been £400,000 in one half-year. The passenger revenue at the present time was £280,000, an increase of 37½ per cent., or an average over the four years of 9·37 per cent. per annum. The service, as they knew, had been greatly increased and accelerated. They had increased their train-mileage 38 per cent., and that was practically the full measure of the service placed at the disposal of the company. They ran 36 trains in the hour between South Kensington and the City, and Mr. Stanley told him that he hoped very shortly to get that increased to 40 trains in the hour. The balance of debenture interest in June, 1906, was £60,595, which fell short by nearly £40,000. Now, that adverse balance had been converted into a surplus of £63,000. The position, as regarded the capital account, was equally satisfactory. In June, 1906, they had a debit balance of £100,000, and temporary loans amounting to £165,000, together £265,000. To-day they had to the credit of the capital account £99,981, and a renewals reserve amounting to £30,452, and there were unissued prior lien debentures, which could be used for any necessary expenditure, with the consent of debenture-holders, amounting to £200,000. He thought, therefore, they might regard the financial position with equanimity. The really interesting period, how-

ever, was the past nine years, and during that time, the District Railway had been saved from wreck—saved for the benefit of the public and the shareholders. He thought he might say with confidence, that except in regard to the rolling stock to which he would not commit himself, the shareholders had one of the finest underground railways in the whole world. With regard to the future, he saw no reason why the District should not for many years enjoy great prosperity. Its location was good, and it served good residential districts. It might be necessary to spend money shortly on the rolling stock, but that could be raised from the renewals fund. The most important question they had to consider was that of fares. In June, 1906, their average receipt per passenger was 1·67d., and on such a figure a line with the length of the District could not possibly live. In September, 1906, alterations were made in the fares, and the average receipt per passenger was now 1·86d. If they had kept at their old figures they would be losing now £70,000 per annum owing to the larger percentage of shorter distances and lower fares. He was no advocate of high fares, and he thought that their charges of 3d. and under were reasonable and yielded a maximum traffic. It was impossible to think of raising the lower fares whilst they had the overhead competition of the omnibuses. In conclusion, Sir George paid a warm tribute to the help Mr. Stanley had given him and the company, and also referred to the loyalty of the staff, and remarked that he regretted leaving the company, and he could only wish a prosperous career for the undertaking in the future.

Lord George Hamilton, in seconding the resolution, referred to the work done by Sir George Gibb, and said that, although it was true that Mr. Stanley had given their chairman valuable assistance, yet it was mainly due to Sir George's sound acumen and judgment that most of the improvements had been effected.

The report was adopted.

Barbados Electric Supply Corporation, Ltd.

The statutory meeting of the shareholders of this company was held on Wednesday at Basildon House, Moorgate Street, Mr. L. W. Hawkins presiding.

The Chairman said that the meeting was purely of a formal character, called in compliance with the Companies' Consolidation Act. The electric lighting order, to acquire which the company was formed, was sanctioned by both branches of the Barbados legislature in May. Since the issue of the prospectus, Mr. W. C. Kenny, a director of the Royal Mail Steam Packet Co., and an old resident in Barbados, had been asked by the directors to join the board, and he had done so. His knowledge of local matters had already proved of great assistance, and they were confident that when his election came up for confirmation at the first annual general meeting, that confirmation would be readily given by the shareholders. Mr. W. C. Shettle had been appointed general manager and resident engineer in Barbados, and sailed in company with Mr. Hooghwinkel, the company's consulting engineer, on the 6th of last month. They had received communications from both of them since their arrival, and the reports received from them and from the company's solicitor in Barbados in regard to the demand for electrical energy were of an encouraging character. The greater part of the plant and materials required for the equipment of the undertaking had been ordered, and a portion of them had already been shipped. A site had been secured, and it was anticipated that construction would shortly commence. There being no questions from shareholders, the proceedings terminated with a vote of thanks to the chairman.

The statutory report shows that £11,995 was received by the company in respect of 23,415 preferred and participating shares allotted; no advice has been received in regard to shares allotted in Barbados.

Tyneside Tramways and Tramroads Co.

The half-yearly meeting of the shareholders of the Tyneside Tramways and Tramroads Co. was held at Newcastle-on-Tyne on August 9th. The half-yearly report stated:—"The surplus of receipts over expenses is £3,656, which, with the balance brought forward from last half-year of £521, makes a total to the credit of profit and loss account of £4,177, and after deducting interest on debentures, loans, &c., amounting to £1,033, there remains an available balance of £3,144. This profit the directors propose to appropriate as follows: (1) In the payment of dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax), £601; (2) in the payment of dividend on the ordinary shares at the rate of 1 per cent. per annum (less income-tax), £669; (3) in placing to the credit of reserve for renewals, depreciation and other contingencies, thus increasing the amount to £8,500, £900; (4) in setting aside for the reduction of registration and formation expenses, £330; making a total of £2,500, and leaving to be carried forward to next half-year, £643. The sum brought forward this half-year is £121 less than was brought forward to the corresponding half-year in 1909, and the amount available for division is £102 less than at June 30th, 1909. The traffic receipts, which, during the earlier part of the year, were less than those of the corresponding period of last year, improved towards the close of the six months, with the result that they show an increase for the half-year of £145 9s. 11d. The trade of the district now appears to be improving."

Dr. J. T. Merz, chairman of the company, presided, and in moving the adoption of the report, said that although the traffic receipts had increased, they had not reached their anticipations, and had not recovered the position they were in three years ago. Ordinary traffic had decreased £233, but that had been made up by a small increase in workmen's traffic of £42, and an increase of £336 on holiday traffic. Practically the car-mileage and expenses were the same as in the preceding year. They had written off £900 to reserve, and £330 for preliminary expenses. During the past few weeks there had been an increase of £205 in the receipts. Mr. W. H. Knowles seconded the adoption of the report, which was agreed to.

Lanarkshire Tramways Co.

The eighteenth ordinary meeting of the above company was held on August 4th, at 83, Cannon Street, E.C., under the chairmanship of Mr. A. R. Monks, when the following report was presented. The proceedings were purely formal, the report being adopted on the motion of the Chairman, seconded by Mr. H. C. Levis:—"For the half-year ended June 30th, 1910, revenue amounted to £36,181, and expenses to £20,599, leaving £15,582. Deducting contributions payable to local authorities £825, and interest on debentures £608, and adding balance brought forward from December 31st, 1909, £1,329, there remains a balance of £15,477, which the directors recommend to be disposed of as follows:—£9,432 to dividend at the rate of 5½ per cent. per annum on the issued share capital; £6,045 to revenue new account. The traffic receipts show an increase of £4,058 over those for the corresponding period of last year. This increase is attributable to the improved trade conditions and the extensions to Uddingston and Newmains, which were opened for public traffic in July, 1909. The expenses show an increase of £2,913. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year."

Great Northern and City Railway Co.

The Earl of Lauderdale presided on Wednesday over the half-yearly meeting of the above company, held at Westminster Palace Hotel, Victoria Street.

In moving the adoption of the report (see p. 225), the Chairman said it would be seen from the traffic returns that they had carried 75,641 passengers less, and there was a decrease of £525 in the revenue from this source, as compared with the same period last year. The decrease for the first three months amounted to £728, but during the last three months they increased the revenue by £273. Of the net decrease more than half—£288—was attributable to local bookings where tramway competition was severely felt. Foreign bookings were £78 less, but this was due somewhat to the extension of the electric tramways around North London. Season tickets, on the whole, showed a decrease of £159. Of the total decrease of £525 a great part was undoubtedly due to the condition of the weather. There was a fairly good increase in traffic in April, although not up to their expectations; and in May also they began well, but then came the lamented death of the King. In July they gained ground, and they hoped to continue increasing the traffic throughout the current half-year. They had also in connection with the accounts to note a decrease of £614 in miscellaneous receipts, resulting chiefly from advertising rents, but this account having now reached its lowest limit it should show no comparative reduction in the future. They had by careful economy and management, and without varying the efficiency of working, while thoroughly keeping the rolling stock up to date, reduced the working expenses by £1,161, the working expenses showing a percentage of 50·12, as compared with 51·56. The final result was that they were £3,163 to the bad, as against £3,209 last year. That deficiency had been balanced by gifts from their friends, who were interested in the welfare of, and had confidence in, the undertaking. The Bill promoted with the object of constructing a subway at Moorgate, to give a connection to the City and South London and the Metropolitan Railways, had received the Royal Assent, and the work would be put in hand as soon as practicable. The convenience of this connection could not be over-estimated, and they felt sure it would be the means of encouraging through traffic on the railway. He would like, before concluding his speech, to point out the severe competition which existed in the North of London between their company and the electric tramways, and this was further accentuated by the Piccadilly and Brompton Railway. The big shops in the North of London were feeling the effects of the tramways, and the Piccadilly Railway, which took the shopping public to other centres. Sooner or later trade of a different character would spring up in Islington and the surrounding districts, and the convenience of being enabled to shop at their very doors would induce the public to use the Great Northern system again. The convenience of travelling by electric tramways had been dearly bought at the expense of many people, and they could only hope that in the near future their railway would begin to attract that traffic which it had a right to expect.

Mr. Charles Steel seconded the motion, and the report was adopted without discussion.

Moore Light in Germany.—The shareholders in the Moore Licht Gesellschaft have just sanctioned the increase of the share capital from £60,000 to £87,000 for the purpose of acquiring further foreign patents; and the issue of the new shares is to take place at the price of 110 per cent. It was stated at the recent meeting that the course of business was in process of regular development and justified favourable expectations.

Stock Exchange Notices.—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—Amazon Telegraph Co., Ltd.—£300,000 5 per cent. debentures, in lieu of the scrip now quoted.

Chatham and District Light Railways Co.

Mr. A. R. Monks (chairman) presided on August 4th at the offices, 83, Cannon Street, E.C., over the nineteenth ordinary general meeting of the company, when the following report was presented :—

"The result of the half-year's working is as follows :—Revenue, £21,601 ; expenses, £12,704 ; leaving £8,897. Deducting rent of Rochester Corporation lines (£1,872) and interest on debentures (£1,234), and adding balance brought forward from December 31st, 1909 (£299), a balance of £6,090 remains, which the directors recommend be disposed of as follows :—£2,940 to dividend at the rate of 5 per cent. per annum on the preference shares, £1,060 to dividend at the rate of 2 per cent. per annum on the ordinary shares and £2,090 to revenue new account. The traffic receipts show an increase of £1,242 over those for the corresponding period of last year, which your directors consider satisfactory. There has also been a saving of £117 in the expenses. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year."

The Chairman formally moved the adoption of the report, and it was seconded by Mr. H. C. Levis, and carried.

Great Northern, Piccadilly and Brompton Railway Co. (London Electric Railway Co.)

The directors have submitted to the proprietors the following report for the half-year ending June 30th, 1910 :—

* The London Electric Railway Amalgamation Act, 1910, the Bill for which was approved by the proprietors at the special meeting held on February 17th last, received the royal assent on July 26th, 1910, and, under the provisions of that Act, the undertakings of the Baker Street and Waterloo Railway Co. and the Charing Cross, Euston and Hampstead Railway Co. have been amalgamated with the undertaking of the Great Northern, Piccadilly and Brompton Railway Co. as on and from July 1st, 1910, and the name of the company has been changed to the London Electric Railway Co.

* Arrangements will be made as soon as practicable for exchanging stock and share certificates existing prior to the date of amalgamation into stock and share certificates of the London Electric Railway Co., in accordance with the provisions of the Amalgamation Act, and a circular will shortly be issued to the proprietors containing directions for carrying out the exchange.

The gross receipts on revenue account amounted to £166,106, being an increase of £8,113 on the receipts for the corresponding half of last year. The working expenses amounted to £69,603, being a decrease of £3,802. After providing for interest, rents, and guaranteed preference dividend, and reserving £6,000 for contingencies and renewals, there remains a balance of £46,832 available for ordinary dividend, and the directors, under the powers contained in the Amalgamation Act, determine that a dividend at the rate of 1½ per cent. per annum be paid on the ordinary shares, leaving a balance of £8,972 to be carried to next half-year's account. This dividend will be paid on August 15th. The following table gives a summary of the working expenses in comparison with the corresponding period of last year :—

	Half-year ending June 30th, 1910.	Half-year ending June 30th, 1909.
Maintenance of way and works, &c. ..	£4,888	£5,890
Repairs and renewals of rolling stock ..	4,512	4,696
Lift expenses	6,538	7,153
Train working and traffic expenses.. ..	42,443	41,585
Other items	4,074	6,005
Rates and taxes	7,148	8,076
Total	£69,603	£73,405

The following table gives a summary of comparative statistics for the first halves of the years 1909 and 1910.

	Half-year ending June 30th, 1910.	Half-year ending June 30th, 1909.
Passengers, including workmen and season ticket holders' journeys	19,978,049	19,155,883
Passengers carried at workmen's fares ..	2,607,550	2,442,573
Passenger receipts	£156,025	£151,073
Average receipt per passenger	1·87d.	1·89d.
Train-mileage	1,267,581	1,226,320
Car-mileage	3,880,808	3,671,512

* The ordinary general meetings of the proprietors of the Baker Street and Waterloo Railway Co., and the Charing Cross, Euston and Hampstead Railway Co. have been convened for the same place and hour as the meeting of the proprietors of this company, and although formal resolutions affecting each undertaking will, so far as may be necessary, be submitted separately to the shareholders of the respective undertakings present at the meeting, the Chairman proposes to consolidate into one address his explanations of the accounts relating to the three undertakings which are now amalgamated.

* Sir George S. Gibb, at the close of this half-yearly meeting, will retire from the board in consequence of his having accepted the chairmanship of the Road Board. The Rt. Hon. Lord George Hamilton, P.C., has consented to act as chairman of the company. To fill the vacancy caused by Sir George S. Gibb's retirement, Mr. Albert H. Stanley will be elected as director, and will be appointed managing director.

* These paragraphs apply also to the reports of the Charing Cross, Euston and Hampstead, and Baker Street and Waterloo Companies, which follow.

Charing Cross, Euston and Hampstead Railway Co.

The report for the half-year ending June 30th, 1910, shows gross receipts on revenue account amounting to £105,627, being an increase of £444 on the corresponding half of last year. The working expenses amounted to £55,539, being a decrease of £2,256. After providing for interest and rents, and reserving £3,000 for contingencies and renewals, there remains a balance of £16,783 available for dividend, and the directors, under the powers contained in the Amalgamation Act, determine that a dividend at the rate of ¾ per cent. per annum be paid on the ordinary shares, leaving a balance of £560 to be carried forward. This dividend will be paid on August 15th. The Bill seeking power to extend the company's railway to a point under the Charing Cross station on the Metropolitan District Railway, approved by the proprietors at the special meeting held on February 17th last, was opposed by property owners on engineering details, and failed to pass the committee of the House of Lords. Further consideration will be given to the question of providing the additional facilities which the scheme sought to provide. The following table gives a summary of the working expenditure in comparison with the corresponding period of last year :—

	Half-year ending June 30th, 1910.	Half-year ending June 30th, 1909.
Maintenance of way and works, &c. ..	£4,998	£4,053
Repairs and renewals of rolling stock ..	3,083	3,357
Lift expenses	4,550	4,981
Train working and traffic expenses ..	35,022	38,134
Other items	3,032	2,403
Rates and taxes	4,854	4,867
Total	£55,539	£57,795

The following table gives a summary of comparative statistics for the first halves of the years 1909 and 1910 :—

	Half-year ending June 30th, 1910.	Half-year ending June 30th, 1909.
Passengers, including workmen and season ticket holders' journeys	15,264,355	14,862,882
Passengers carried at workmen's fares ..	2,692,144	2,728,029
Passenger receipts	£99,196	£100,787
Average receipt per passenger	1·56d.	1·63d.
Train-mileage	1,007,534	991,747
Car-mileage	2,776,545	3,037,868

Under the provisions of the Amalgamation Act, the directors of the Charing Cross, Euston and Hampstead Railway Co. will, so long as may be necessary, continue in office without re-election, and are authorised to exercise all powers necessary for winding up the affairs of the company.

Baker Street and Waterloo Railway Co.

The report for the half-year ending June 30th, states that the gross receipts on revenue account amounted to £93,891, being an increase of £2,381 on the corresponding half of last year. The working expenses amounted to £42,079, being a decrease of £146. After providing for interest, rents, and preference dividend, and reserving £4,000 for contingencies and renewals, there remains a balance of £21,974 available for dividend, and the directors, under the powers contained in the Amalgamation Act, determine that a dividend at the rate of 3 per cent. per annum be paid on the "A" ordinary shares, being the ordinary shares held by persons other than the Underground Electric Railways Co. of London, Ltd., or their nominees, and that a dividend at the rate of 2 per cent. per annum be paid on the "B" ordinary shares, being the remaining issued ordinary shares of the company, leaving a balance of £2,869 to be carried forward. These dividends will be paid on August 15th. The Bill seeking powers to acquire additional land and to construct a subway in connection with a scheme for providing additional accommodation at Oxford Circus Station, which was approved by the proprietors at the special meeting held on February 17th last, has now become law. The proposal to provide a new station, jointly with the Central London Railway Co., was abandoned owing to the opposition of property owners. The following table gives a summary of the working expenditure in comparison with the corresponding period of last year :—

	Half-year ending June 30th, 1910.	Half-year ending June 30th, 1909.
Maintenance of way and works, &c. ..	£3,722	£2,996
Repairs and renewals of rolling stock ..	2,523	2,939
Lift expenses	3,905	4,307
Train working and traffic expenses ..	24,086	24,787
Other items	3,430	2,905
	37,616	37,934
Rates and taxes	4,463	4,290
Total	£42,079	£42,224

The following table gives a summary of comparative statistics for the first halves of the years 1909 and 1910 :—

	Half-year ending June 30th, 1910.	Half-year ending June 30th, 1909.
Passengers, including workmen and season ticket holders' journeys	14,807,736	14,325,065
Passengers carried at workmen's fares ..	1,952,699	1,922,539
Passenger receipts	£88,393	£86,861
Average receipt per passenger	1·43d.	1·46d.
Train-mileage	613,316	637,202
Car-mileage	1,849,918	1,918,562

Under the provisions of the Amalgamation Act, the directors of the Baker Street and Waterloo Railway Co. will, so long as may be necessary, continue in office without re-election, and are authorised to exercise all powers necessary for winding up the affairs of the company.

Liverpool Overhead Railway Co.

The half-yearly general meeting was held on August 10th, Sir William Forwood, chairman of the company, presiding.

The Chairman, in moving the adoption of the report (see p. 226), said the directors were gratified in being able to place before the shareholders a slightly more favourable report than had been the case at some recent meetings. The total traffic had increased from 4,900,216 passengers in the corresponding half-year of 1909 to 5,090,080, the increase being mainly in workmen's special return tickets, and this increase was due to two causes: a slight improvement in the volume of trade passing through the port, and to the reduction made in sectional workmen's fares from 2½d. to 2d., the value per passenger carried being 1·72d., as against 1·76d. last year. Taking the receipts from the workmen's traffic by themselves, the reduction in value was from 1·27d. to 1·24d. To show how the railway had suffered from competition, he mentioned that ten years ago the average receipts from workmen were 1·65d., making a reduction of ·41d. per passenger, or equal to £2,612 on the traffic for the half-year just ended. The necessity for the reductions which had taken place in their fares was proved by the fact that they had done no more than enabled the company to retain their workmen's traffic. The directors had introduced shopping tickets on tramways, and these, combined with the erection of a passenger lift at Seaforth Sands, had increased their first-class passenger earnings at that station. The increase in the revenue during the half-year had been £824, which was a satisfactory feature. On the other side the expenditure had been reduced by £524, so that they were able to show a total improvement of £1,348. The traffic arising from their connection with the Lancashire and Yorkshire Railway continued disappointing. They had placed, as usual, £1,500 to the credit of their renewal fund, which now amounted to £10,051, and also placed £200 to the credit of the contingent fund, raising this fund to £700. Their success in reducing the cost of working the line would be best seen by comparing the expenses for last half-year, which amounted to £25,348, with those of two years ago, which amounted to £29,011, showing a saving of £3,653. There had been a falling-off in imports in consequence of the partial failure of the great crops of the world, but an increase in the volume of exports. The Overhead Railway was more dependent on imports than on exports, as it was the imports of raw produce which gave the greater amount of employment. Their railway should benefit by the construction of the new Atlantic Dock at the north end of the dock estate, which is to be proceeded with at once. The profits for the half-year, after paying interest upon their debentures, amounted to £4,979. To this must be added the balance brought forward of £1,613, making the total sum available for dividend £9,592. Out of this the directors recommend payment of a dividend on both classes of preference shares at 5 per cent. per annum, leaving a balance of £5,916 to be carried forward. This was the first time since 1907 that they had been able to pay a dividend in the first half-year on their second preference, and they were hopeful that it was an augury of better times for the company.

A Shareholder having remarked that the report was the best they had had for several years, it was unanimously adopted, and a further resolution was passed in favour of the payment of the preference dividend as recommended.

Brown-Boveri & Co., Baden.

The decline in the profits of this company, as disclosed by the balance-sheet published a short time ago (the net profits were 2,142,122 fr., against 2,752,809 fr. last year, and a dividend of 8 per cent., against 11 per cent., was proposed) says the *Manchester Daily Guardian*, caused the fuller report to be awaited with more than usual interest. This has just been issued, and states that, in spite of some revival in demand, prices fell steadily throughout the year, and are still unsatisfactory. The productive capacity of the industry has increased rapidly of late; every order is now keenly fought for, and quotations are approaching levels which leave no margin of profit. The German market is referred to as being particularly bad in this respect. The prices of steam turbines are exceptionally poor, and the company have curtailed their output in this department. The French branch of the company has just received an order for six 20,000-H.P. turbines for the generating station in Paris. They are engaged at present in working out simpler and cheaper models, which they think will prove satisfactory. Little or no progress is being made with the electrification of the Swiss railways, and but few generating stations are now being erected in Switzerland. The Prussian State Railways have ordered one of the company's electric locomotives, and have shown great interest in their single-phase alternating-current system. This system is being largely adopted by mining companies. The foreign companies in which the Baden concern is interested financially have paid about the same dividends as last year; the Tecnomasio Italiano Brown-Boveri, Milan, are again paying 6 per cent., the Electro-Mécanique Le Bourget (Paris) are again paying 10 per cent., the Aktieselskabet Norsk Electrisk and Brown-Boveri (Christiania) 3 per cent. as before, whilst Brown-Boveri & Co. (Mannheim) have suffered from the depression in the German market, and are only paying 4 per cent., against 6 per cent. last year. The parent company have recently purchased an interest in the Austrian Brown-Boveri Co. (Vienna), and have also formed a small subsidiary company in Holland. The capital of the company now amounts to 20 million fr., and there are in addition loans to the amount of 10 million fr.

Central London Railway Co.

The thirtieth ordinary general meeting of the shareholders of the above company was held on Thursday last week at the Holborn Restaurant, Sir Henry Oakley presiding.

The Chairman, in proposing the adoption of the report (see page 224), said there was nothing of real importance that had happened during the past half year. They had earned £4,597 more and had saved £1,974 in working expenses, making a total net gain of £6,571. There had been neither accident nor any misadventure of any sort during the half-year. The practical result was that they had on the credit side of the revenue account £85,000, which would allow of a dividend of 3 per cent. on the undivided ordinary stock, and 4 per cent. on the preferred ordinary, and after providing for the interest on debentures, there was a carry forward of £40,000. They had in addition provided for half of the dividend on the deferred stock, which, as they were aware, could only be paid at the end of the year. The company was, therefore, for the time being, in what he might call a happy and comfortable position. They were gaining ground slightly, but they admitted in a somewhat disappointing sense, because they had hoped that with the development of trade they would have increased their receipts in a greater proportion than they actually had. Possibly a part of the loss or gain could be attributed to the weather, probably also to the sad calamity which had befallen the nation in the death of the King, which they knew from actual experience had had a marked effect on their traffic, especially in business parts of their undertaking. They had carried an increased number of passengers—1,675,787 in the half-year, which in itself was a satisfactory feature, but, as they were all aware, their fares were so small—1d. lowest and 3d. highest—that it took a great many millions to earn a substantial sum. One very encouraging feature of the past half-year's work was the increase in the number of through bookings. It was satisfactory to be able to say that the other lines took the same view of the desirability of developing this through passenger traffic as much as possible. The Central London had carried 420,000 more through-booked passengers in the last six months than in the corresponding period last year, and they were in great hopes that that was only an encouraging symptom of future traffic. He thought he might say that all the other companies concurred and acted cordially with each other in endeavouring to develop that class of traffic. The only difficulty was in regard to the division of the fare between the various companies over whose lines the person travelled, but he had no doubt that, like men of common sense, they would come to an understanding about it, and he looked to that particular element in their traffic as being the harbinger of success in the near future. The 1d. passengers had increased in number—2,290,390—in the course of the half-year. That was very satisfactory, and there was only one regret in connection with it, and that was that the fare was so low. They only charged a penny for three stations, and that certainly had developed a large local traffic that they had not possessed before, but, of course, it was not so remunerative as when they received a higher fare for the same distance. They were obliged to adopt that low fare in order to meet the overhead competition of motor-'buses, &c. They had gained nearly 9 per cent. in passengers but only 2 per cent. in money. That would give them some idea of the effect of low fares. There had not been a very heavy expenditure on capital account. The money that had been spent was on the replacing of the wooden platforms by stone, and some improvements on their machinery at Shepherd's Bush. The latter had been undertaken in order to lessen, as far as possible, the cost of creating their power, and in that they had succeeded, and, of course, it acted materially in the reduction of the working costs. Then, in addition to that, they had spent £1,500 out of the revenue which ought really to have belonged to the capital account. Dealing with the resolutions which were to be submitted in reference to the raising of further capital at a subsequent meeting, Sir Henry said that the stockholders were aware that under the recent Act the company obtained powers to extend their line from the Bank to Liverpool Street. The directors after close and careful inquiry were satisfied that it would make a very admirable and profitable addition to their undertaking. The contract for the carrying out of the work had been let, on what they thought were favourable terms, and the time had come when they must raise the money to make the extension, and it was for that reason a special meeting was convened that day. In addition to the powers given to them by their Act of 1903, they had power to raise £150,000 share capital, and £50,000 debentures authorised in the year 1902, and they would remember that in 1903 resolutions were passed sanctioning the creation of the capital thereby authorised. The directors had, however, come to the conclusion that it was not expedient to raise so small a sum as that. They, therefore, used the money they had saved out of revenue, and also the money that they received daily for capital purposes, and to-day capital owed to revenue £114,000. That money must be paid some day, and they thought that this was a very appropriate time to raise it, and what the directors recommended was to combine the powers of 1902 and those of 1909, and raise £480,000 share capital. They need not be alarmed; they were not going to spend all at once, but it was better to have one large useful stock rather than many small ones. They would, therefore, ask the shareholders to abandon the resolutions of 1903, and in lieu thereof to sanction the creation of other capital. The £480,000 would be created as a 4½ per cent. preference, and the directors were convinced that the traffic on the extended portion of the line would be equal to that on any other part of the system. They were authorised to spend £10,000 in the payment of interest during construction, and they were clearly of opinion that the work would be completed in the period allowed, and that the amount paid in interest would not exceed £10,000. They would probably spend

something on additional rolling stock, and there might possibly be some moderate addition to their works at Shepherd's Bush, but their total expenditure on this extension would not exceed £300,000, and it was with the belief and faith that the advice given to them was sound and reliable that they recommended the shareholders to raise the money. Of course one did not like to prophesy until they were a little more advanced, but the figure of £300,000 was put before them after the most careful consideration and on the advice of their engineers. He had omitted to mention that they had in hand the construction of the subway at their Bank station, giving access to the City and South London system. This scheme was estimated to cost £6,000, but each company was paying half.

Lord St. Aldwyn seconded the motion, and after a short discussion, the report was adopted.

At a subsequent special meeting, the following resolutions were adopted, on the motion of the Chairman, seconded by Lord St. Aldwyn, without comment:—

1. That the resolutions passed at the extraordinary general meeting of the company held on February 4th, 1903, as to raising the £150,000 additional capital authorised by the Central London Railway Act, 1902, by the creation and issue of new ordinary shares, and as to the exercise of the company's borrowing powers under such Act, in respect of such additional capital, be and the same are hereby rescinded.
2. That pursuant to the powers conferred by the Central London Railway Act, 1909, the £150,000 additional capital authorised by the Central London Railway Act, 1902, and the £330,000 additional capital authorised by the Central London Railway Act, 1909, be raised by the creation and issue of new preference stock entitled to a preferential dividend at the rate of 4½ per cent. per annum, and the directors are hereby authorised to dispose of such new preference stock in such manner as they may think most beneficial to the company.
3. That pursuant to the powers conferred by the Central London Railway Acts, 1902 and 1909, and subject as in such Acts provided, the company do in respect of the said £150,000 additional capital authorised by the Central London Railway Act, 1902, borrow on mortgage of the undertaking sums not exceeding in the whole £50,000, and in respect of the said £330,000 additional capital authorised by the Central London Railway Act, 1909, borrow on mortgage of the undertaking sums not exceeding in the whole £110,000.
4. That the directors be and they are hereby authorised to take all necessary steps for carrying the above resolutions into effect.

Consolidated Electrical Co., Ltd.

The directors' report for the year ending March 31st, 1910, states that the ordinary income amounted to £5,760, in comparison with £6,512 for the previous year. On the present occasion no credit is taken in the revenue account for certain interest accruing from the two subsidiary companies, the affairs of which are now in process of winding-up. In the previous year's accounts this interest amounted to £812. The general charges for the year amounted to £1,332, in comparison with £1,562 for the preceding 12 months, and were lower than in any previous year in the history of the company. In view of the improbable recovery of certain accounts outstanding with the subsidiary companies, the directors have thought it prudent to write off £5,000 from "sundry debtors" against the revenue account of the past year. Of the balance of £6,814 standing to the credit of revenue account, the interim dividend of 3 per cent. paid on the preference shares on January 1st, 1910, absorbed £450, leaving a disposable balance of £6,364. The final dividend of 3 per cent. paid on the preference shares on the 1st inst. absorbed £450, and the directors now recommend the payment of a dividend of 3½ per cent. for the year on the ordinary shares. This will absorb £3,850, and leave a balance of £2,064 to be carried forward. The directors are satisfied that the valuation placed upon the company's investments in the balance-sheet is well within their intrinsic and realisable worth. The death is recorded of Mr. J. H. S. Thomson, who had been a director of the company almost from its inception; Mr. Richard Barnett has been elected a director to fill the vacancy caused by Mr. Thomson's death. The director retiring upon the present occasion is Mr. Herbert Allen, who offers himself for re-election.

Mr. Herbert Allen (chairman) presided at River Plate House, E.C., on Thursday, August 4th, over the eighth ordinary general meeting of the above company.

In moving the adoption of the above report, the Chairman said the accounts before them were very brief and very simple, as usual, and, taken in conjunction with the report, they were so explicit, that they left him practically nothing to add by way of elucidation. He had just been glancing over what he told them in that room a year ago, and if he were to read his opening address of that occasion, it would apply almost equally well to the facts and figures before them now and the position of the company at the present time. They had made some slight departures in the method of dealing with certain items of the revenue account, and they were explained in the report. They thought it prudent to write off a certain sum for doubtful debts in order that the item of sundry debtors in the balance-sheet might not be held to be misleading. They were paying ½ per cent. more dividend this time, and he did not expect that anyone would complain of that. These were the three principal features in the report and accounts, and, beyond any questions which might be asked, he should let the facts and figures speak for themselves.

Mr. Charles Woolley seconded the motion.

Mr. Hibbert said he thought the chairman might have given them some hint as to the future prospects of the company. So far as he could see, there was only one asset of any real value, viz., the shares in the Anglo-Portuguese Telephone Co., and that was the only source from which they derived any revenue. He could see no reason for the company going on much longer as it was, for it was really taking a cheque and dividing it. At the same time, he had every confidence in the directors, and he did not suggest for a moment that they were continuing the company for the sake of their fees.

Mr. Wetherall thought that the expenses were not accurately stated, and should be some £200 more than appeared in the balance-sheet, because of the money they took into account, the income-tax which they deducted.

Mr. Michael said that three years ago he came to the meeting in a very hostile spirit. Mr. Allen then said he had a well defined policy which he was going to carry through, and that he was prepared to talk it over with any shareholder, but would not divulge it in general meeting. He saw the chairman, and was satisfied that his policy was a good one, and would ultimately result in benefit to the shareholders. He had no relation with Mr. Allen of any kind, but he was satisfied, as was also another gentleman who was a large holder. Therefore, he did not think it was well to bait the chairman. Three years ago the chairman promised that they would undertake no new business whereby their assets might be imperilled, and therefore he saw no objection to the way things were now going on.

The Chairman, in reply, said it was perfectly true that practically their only source of revenue were the shares of the Anglo-Portuguese Telephone Co. The expenses as set out in the balance-sheet were absolutely correct. He was quite satisfied that the policy they were pursuing of not unduly hastening the winding up of the company was a good one. It was no question of the directors hanging on to fees, for the directors and their friends had the largest interest in the company, and they would choose what, in their honest opinion, was the best time for winding up the company. Personally, he thought the time was very near at hand when they would wind up and distribute the assets either in cash or kind, but it was not so easy a task as some gentlemen seemed to think. They had to pay out their preference shareholders, and their creditors, which meant about £30,000 in cash, and to do that they would have to part with some of their Portuguese shares. If they sold part of them it would make it exceedingly difficult to dispose of the rest to advantage, whilst if they distributed the remainder, there would be great disadvantages. If they were not careful the shares would become an unmarketable security. Of course they could wind up in a reckless fashion, but that would not be for the advantage of the shareholders. The directors were, or should be, the best judges of the physicological moment for taking such a step, and immediately they felt that time had arrived they would proceed to liquidation. The chairman proceeded to refer to an extract from a daily paper which had been sent him describing the company as an unfortunate finance company, and said that, as a matter of fact, they had been rather fortunate as a finance company. As a finance company they had been in existence seven years and had distributed 78 per cent.

The report was adopted.

Replying to a vote of thanks, the Chairman said his own feeling was that the company would be put into liquidation within the next 12 months.

Ottoman Electrical Union.—The Union Ottomane Société pour Entreprises Electriques en Orient, which was formed a year ago as an international syndicate under the lead of the Deutsche Bank, for undertaking electrical enterprises in Turkey, reports profits of £3,530 for the first financial year ended with June. After a slight allocation to the reserve fund, the balance has been carried forward. The company, which is still in a preliminary stage, has a share capital of £480,000, of which one-half is paid.

Continental.—Switzerland.—The report of the Banque pour Entreprises Electriques, of Zurich, for the last financial year shows a net profit of £175,253, as compared with £175,167 in the preceding 12 months; the dividend is being maintained at 10 per cent. An important item of news is to the effect that the bank is acquiring the undertaking of Messrs. W. Lahmeyer & Co., electrical engineers, of Frankfort-am-Main. The bank is largely controlled by the A.E.G.

Waste Heat and Gas Electrical Generating Stations, Ltd.—Interim dividend of 5 per cent. per annum for the half-year ending July 31st, 1910; the dividend will be paid, less income-tax, on August 31st.

Electric Welding Co., Ltd.—The report states that the accounts for the year to November 30th, 1909, show a loss of £2,028 (including £1,176 for debenture interest), increasing the debit to balance of profit and loss account to £31,458.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books and register of members will be closed from August 18th to 31st, 1910 (both days inclusive), for the preparation of dividend warrants payable the 31st inst.

North Metropolitan Tramways Co.—The report states that the accounts for the half-year to June 30th shew a net profit of £385, which, together with £81 brought forward, make up a sum of £466 to be carried forward.

Melbourne Tramway and Omnibus Co., Ltd.—A bonus for the year ended June 30th last at the rate of 5 per cent. (6d. per share) has been declared.

Birmingham Railway Carriage and Wagon Co., Ltd.—Interim dividend of 7½ per cent. per annum on the ordinary shares, free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.	£*	No. of wks.	Total to date.	£*	Route miles open.	Inc.
Aberdeen	Aug. 4	3,143	+ 12	9	13,889	— 76	..	..
Ayr	„ 6	1,010	+ 11	12	5,026	+ 221	..	..
Bath	„ 3	2,177	— 53	31	24,725	+ 1,220	..	..
Belfast	„ 5	8,127	+ 339	18	73,462	+ 2,951	37	..
Birkenhead	„ 7	2,390	+ 104	18	20,524	+ 426	13·68	..
†Birmingham Corp.	July 30	6,662	+ 216	..	116,461	— 167	56·46	..
Blackburn	Aug. 3	2,147	+ 58	19	20,475	— 778	..	..
Blackpool Corp.	„ 5	6,407	+1,571	..	23,498	+ 277	..	..
†Blackpool-Fleetw'd	„ 6	2,566	+ 119	5	7,627	+ 313	..	..
Bolton	„ 7	5,041	+3,020	19	44,272	— 372	26	..
Bournemouth	„ 3	4,493	+ 202	18	34,864	+ 4,004	21·96	..
Bradford	„ 6	10,887	+ 576	19	95,190	— 3,145	54·81	..
Brighton	„ 8	3,639	+ 361	18½	19,133	— 52	..	..
Bristol	„ 5	14,463	+ 898	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	July 29	355	— 39	30	6,513	+ 81	3·65	..
Barnsley	„ 29	335	..	30	5,059	+ 140	..	..
Barrow	„ 29	666	+ 107	30	7,418	+ 1,121	5·37	..
Cavehill	„ 29	208	— 2	30	2,784	+ 215	..	..
Devonport	„ 29	828	+ 77	30	12,367	+ 1,509	8·85	..
Gateshead	„ 29	2,086	+ 32	30	29,350	— 209	11·25	..
Gravseend	„ 29	476	— 65	30	6,068	+ 28	6·5	..
Greenock	„ 29	1,412	+ 39	30	18,444	+ 2,590	7·25	..
Hartlepool	„ 29	622	+ 73	30	7,092	+ 375	6·72	..
Kidderminster	„ 29	256	— 12	30	3,074	+ 64	..	..
Leamington	„ 29	386	— 37	30	4,792	— 190	..	..
Merthyr	„ 29	418	— 7	30	6,101	— 205	2·9	..
Metropolitan	„ 29	15,863	+1,629	30	219,319	+39,289	22	..
Middleton	„ 29	702	— 18	30	9,370	— 563	8·5	..
Mid. Joint Com'tee	„ 29	11,437	+ 207	30	170,985	+ 1,599	..	..
Oldham—Ashton	„ 29	1,164	— 2	30	16,514	— 69	9·13	..
Peterborough	„ 29	249	— 16	30	3,362	— 49	5·31	..
Potteries	„ 29	3,629	..	30	52,279	— 498	29	..
Rothesay	„ 29	1,489	+ 24	30	5,755	+ 198	2·75	..
Southport	„ 29	634	— 7	30	8,548	+ 230	8·17	..
S. Metropolitan	„ 29	1,652	— 63	30	24,090	+ 1,216	..	..
Swansea	„ 29	2,300	+ 281	30	31,509	+ 3,738	12·5	..
Tynemouth	„ 29	864	— 52	30	6,981	+ 481	3·75	..
Weston-s-Mare	„ 29	570	+ 28	30	3,449	+ 119	3	..
‡Worcester	„ 29	645	+ 2	30	8,162	+ 181	5·75	..
Wrexham	„ 29	195	— 2	30	2,868	+ 14	..	..
Yorks. Wool. Dist.	„ 29	2,215	+ 128	30	29,288	+ 2,594	17	..
Miscellaneous	„ 29	500	+ 29	30	6,278	+ 293	..	..
Burnley	Aug. 6	2,590	— 69	..	..	..	..	..
Burton-on-Trent	„ 7	618	— 4	18	4,993	— 45	6·63	..
Bury	„ 7	2,442	— 8	18½	22,053	— 378	22·5	..
†Cardiff	July 23	2,325	— 103	17	36,937	+ 599	..	..
Carlisle	..	..	..	..	..	..	..	..
Chatham and Dist.	Aug. 4	2,202	+ 221	31	25,754	+ 1,128	14·98	..
Cork	„ 4	1,069	— 20	31	14,983	+ 1,649	..	..
Croydon	July 29	3,325	+ 318	..	29,322	+ 3,203	..	..
Darlington	Aug. 6	433	+ 39	19	3,759	+ 205	..	..
†Darwen	July 29	230	+ 14	17	4,257	— 126	4·36	..
Dover	„ 30	517	+ 26	17	3,706	+ 46	..	..
Dublin	Aug. 5	12,170	+ 113	..	30,963	+ 385	..	..
Dundee	„ 3	2,489	+ 49	11⅔	14,066	+ 313	15·5	..
East Ham	„ 6	2,269	+ 173	18	19,280	+ 388	..	..
Exeter	„ 5	778	— 28	18	6,016	— 651	..	..
Glasgow	„ 6	31,708	+ 363	..	168,482	+10,286	..	..
Hastings	„ 4	3,131	+ 120	..	..	..	..	..
Huddersfield	„ 6	3,751	+ 343	18	32,506	+ 1,852	28·5	·5
Hull	„ 6	5,674	+ 176	18	49,510	+ 3,014	14·5	1·5
Ilkeston	„ 3	291	— 8	18	2,335	— 114	..	..
†Ipswich	July 30	589	+ 117	17	7,320	+ 313	10·5	..
†Kilmarnock	„ 30	244	+ 7	11	1,777	+ 29	4·25	..
Lancashire United	Aug. 3	2,886	+ 190	31	40,307	— 215	39	..
Leeds	„ 6	16,197	+1,549	18	131,752	+ 4,921	..	..
Leicester	..	..	..	..	..	..	..	..
Leith	„ 6	1,309	— 39	..	7,822	+ 140	8·72	2
Liverpool	July 30	23,131	+ 930	30	333,527	+12,856	113·5	6
‡L.C.C.	„ 27	83,221	+7,357	..	711,507	+98,399	133	13·5
London United	Aug. 6	16,045	+ 702	..	196,921	+10,073	..	..
Lowestoft	..	..	..	..	..	..	..	..
Manchester	„ 6	31,389	+ 547	18	268,680	+ 4,758	183	1
Newcastle	„ 6	8,575	+ 764	..	74,003	+ 882	14·5	..
Newport	„ 6	1,583	+ 69	19	13,215	+ 498	14·5	..
Oldham	„ 7	3,721	— 72	19	36,039	— 1,013	23·75	..
Pontypridd	..	..	..	..	..	..	..	..
Portsmouth	„ 6	5,602	— 500	..	38,918	— 1,727	15·25	.75
Preston	„ 3	1,485	+ 42	..	..	..	..	..
Rotherham	..	..	..	..	..	..	..	..
†Salford	„ 1	5,030	+ 476	17½	82,972	+ 1,188	..	..
Sheffield	„ 7	12,056	+ 718	19	115,528	+ 6,548	39·8	·8
Southampton	„ 3	2,576	+ 17	18	20,013	+ 568	..	..
Southend-on-Sea	„ 3	2,009	+ 221	18	10,972	+ 893	..	..
†South Shields	July 30	601	+ 6	17	9,771	— 79	..	..
Swindon	Aug. 3	333	+ 36	..	..	..	..	..
Tyneside	„ 3	1,178	+ 215	5	2,589	+ 206	..	..
Wallasey	July 30	2,152	+ 170	17	16,533	+ 192	..	..
Walthamstow	Aug. 6	1,846	+ 268	18	13,778	+ 970	9	..
West Ham	July 28	4,985	+ 196	17	42,272	+ 1,332	15·25	..
Wolverhampton	Aug. 3	2,054	+ 309	18	17,250	+ 2,343	14·25	1·75
Can. London Rly.	„ 6	10,385	+ 534	5	27,726	+ 1,546	6·22	..
City & S. Lon. Rly.	„ 7	6,276	+ 108	5	15,530	+ 94	7·26	..
Dublin-Lucan Rly.	„ 5	367	+ 7	5	890	+ 24	7	..
G.N. and City Rly.	„ 6	2,522	+ 101	5	6,502	+ 152	3·5	..
L'pool Overh'd Rly.	„ 7	3,234	+ 113	5	8,974	+ 37	6·8	4·8
Llandudno-Col. Bay	July 29	1,081	— 15	34½	7,530	— 14	..	..
London Elec. Ry. Co.	Aug. 6	23,520	+ 650	5	60,970	+ 310	21·25	..
Mersey Railway	„ 6	4,115	+ 119	5	9,951	+ 189	4·5	..
Metropolitan Rly.	„ 6	33,083	+1,498	..	84,899	+ 2,686	24·5	..
Met. District Rly.	„ 6	20,644	+2,078	5	53,306	+ 3,384	24	..
Anglo-Argentine	„ 5	86,418	+12,399	..	1,367,296	+160,361	..	..
§Auckland	June	15,046	+ 833	24	88,975	+ 5,874	23	·7
Bombay (B.E.T.)	July 24	5,296	+ 304	25	68,220	+ 4,672	..	..
§Brisbane	July	13,115	+1,975	30	122,845	+14,018	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Aug. 6	6,949	+ 543	..	..	..	..	..
§Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	June	3,606	..	..	20,571	..	20·5	..
Madras	July 31	1,383	+ 107	..	18,680	+ 1,151	..	..
Montevideo	July	20,614	+2,977	..	213,363	+19,719	..	..
§Lisbon	..	..	..	..	..	..	..	..
†Perth (W.A.)	July 15	1,529	+ 149	..	43,273	+ 8,971	29	1

* Compared with the corresponding period of 1909. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

THE record of the past week has again been of a somewhat mournful character. Consols have developed a shrinking tendency, which overshadowed other investment markets round the House, and in no department except the American Railroad and the South African Mining Section has there been anything approaching strength.

The Home Railway market should have benefited considerably by the dividend declarations of the last week or two, but as a matter of fact, after a little spurt here and there, prices sank back into a deadly dull condition. The reports of the "Bakerloo," Great Northern and Piccadilly, and Charing Cross and Euston Railways made a very good showing for their last, because in future, of course, the returns will come out from the amalgamated single railway company. Great Northern, Piccadilly and Brompton Preference have been quietly rising, and are now up to 9. Underground Electric Railway of London issues are a shade harder, while District and Metropolitan stocks are on the dull side in sympathy with the rest of the principal stocks in this market.

The Great Northern and City meeting was, as usual, a more or less lugubrious affair, and the chairman held out very little hope of an immediate return to better days.

Amongst electric supply shares, a feature has been the quiet rise in Metropolitans, which have hardened to 3¼. Westminsters gained ⅛, and London Electric Preference improved a small fraction. South Metropolitan eased off, and South Londons fell 5s.

The American Electric issues, generally, have been under the influence of some depression in consequence of the upshot of certain New York Stock Exchange operations on behalf of what is called the Pearson group. This caused all the Canadian-Mexican issues to be dull, and although the American Market has recovered, the incident has left its mark upon prices in the Traction division.

Canadian General Common and Preferred are 105 and 123½ respectively. Shawinigan Water and Power capital stock stands at 99, while Montreal Light, Heat and Power capital stock, which gets a 7 per cent. dividend, has been done within the last few days at 131¼.

On the other hand, while the shares and stocks have shown a tendency to droop, the bonds of the various undertakings are distinctly firm. Mexico Tramways shares, for example, have fallen 1, but the first mortgage bonds are ½ better. Mexican Light and Power fives are higher at 92½, and Electrical Development of Canada 5 per cent. gold bonds at 88 show a rise of 2 points.

The Telegraph and Telephone market is quiet, the feature being a rise of 2s. in Marconi shares. Possibly the hint conveyed here last week as to the fine advertisement secured by the company by reason of the Crippen case may have been accepted by some readers. United River Plate Telephone shares are better, and the two Debentures issues of the National Telephone Company have been marked up a point apiece. Anglo-Portuguese Telephone 5 per cent. Debenture rose the same amount to 102.

After the vigorous rise of last week in Anglo-American Telegraph Deferred stock, a downward reaction cannot be considered surprising. The Preferred stock also eased off, and Mackay Companies 4 per cent. Preferred fell 2. Submarine Cables Trust certificates, which so rarely fluctuate, gained 1. American Telephone and Telegraph capital stock recovered part of its last week's decline.

In the traction department the monotonous note of depression is struck by small shrinkages in Anglo-Argentine Second Preference Shares, and British Electric Traction First Debenture. Calcutta Trams are without alteration at 4¼; it is hoped that the company's troubles with dishonest employés are now at an end. The manufacturing and industrial division is very quiet. Dick Kerrs are ⅛ lower, but a similar fraction has been gained by Castner-Kellner shares.

American Telephone and Telegraph Co.—The report for the first half of 1910, says the *Electrical World*, shows a substantial improvement over the corresponding period of last year. It appears that the total earnings of the company for the six months expanded more than $2,300,000, while the net earnings showed an increase of nearly $2,000,000. The company's gross revenues were about $17,595,000, and the net profits were almost $16,000,000. Last year the company's total earnings, including dividends, interest, traffic and other receipts, amounted to almost $33,000,000, or about $5,000,000 more than in the previous year. The net income available for dividends for the first six months of 1910 was equal to 5·12 per cent. on the present $259,694,200 capital stock outstanding. This is at the rate of 10·24 per cent. for the year, and indicates that after the regular 8 per cent. dividend has been paid there will be a material surplus carried over.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Aug. 2nd.	Closing Quotations Aug. 9th.	Business done week ended Aug. 9th, 1910.		Rise + or Fall —	Present Yield per cent.
		*	1906.	1907.	1908.	1909.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜— 3⅞	3⅜— 3⅞	..	..	..	Nil.
286,500	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	95 — 97	95 — 97	96⅜	..	..	4 17 7
$265,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	8 %	134 —137	135 —138	..	..	+1	5 15 11
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	91 — 93	91 — 93	..	..	..	4 6 0
558,460	Anglo-American Telegraph	Stock	3¾%	3¾%	£3 4s.	3¾%	64½— 66½ xd	64 — 66	..	..	— ½	5 9 10
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	107 —109 xd	106½—108½	107⅜	106½	— ½	5 10 7
3,220,770	Do. do. do. Deferred	Stock	1¾%	1 %	8/-	25/-	26¼—26⅜	25½— 26	26⅛	25⅝	— ⅜	4 16 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102	101 —103	..	..	+1	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	9 — 9⅛ xd	9 — 9⅛	9¼	..	..	4 4 3
2,449,176	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	83⅝— 85½	83½— 85¼	85	83½	..	4 13 7
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8¼— 9	8¼— 9	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½— 17½	16½— 17½	..	..	..	5 15 11
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3¼— 3⅜	3⅜— 3⅜	..	..	..	5 3 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7⅞— 8¼	7⅞— 8¼	..	..	..	6 1 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
60,710‡	Direct United States Cable	20	4½%	4½%	4½%	4 %	14½— 15½	14½— 15½	15⅝	14 13/16	..	5 4 11
36,000	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	98 —100	98½—100½	..	..	+ ½	4 9 7
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	132 —135	132 —135	134½	132½	..	5 3 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84 — 86	84 — 86	85½	84½	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	102 —104	102 — 104	103½	102	..	3 16 11
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12⅜— 12⅞	12⅜—12⅞	12⅝	12 7/16	..	5 8 9
752,400	Do. 4 % Deb. Stock..	Stock	4 %	4 %	4 %	4 %	99 —102 xd	99 —102	..	..	..	3 18 5
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99½—101½	100 —102	..	..	+ ½	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5⅞%	5⅝%	5⅞%	10½— 10⅝	10½— 10⅝	10 11/16	10⅝	..	5 10 3
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13 — 13½	13 — 13½	13⅜	13½	..	4 8 11
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	29½— 30½	29½— 30½	..	..	..	6 3 0
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	53 — 55	53 — 55	54⅛	..	..	6 15 8
$41,380,400	Mackay Companies Common	$100	3¾%	4 %	4 %	4½%	84 — 88	84 — 88	..	..	..	4 16 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	76 — 80	74 — 78	..	..	—2	5 2 7
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	11— 12	25— 30	..	..	+ 3/16	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	32— 33	17— 18	17/3	15/-	..	6 8 0
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	30— 32	30— 32	..	..	..	6 3 1
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½—108	107 —108½	108½	106½	+ ½	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	126¼—128½	126½—128½	128⅝	126⅝	..	4 13 5
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10½— 10⅝	10⅝— 10⅞	10½	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10½— 10⅝	10⅝— 10⅞	10⅞	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16— 5 9/16	5 7/16— 5 9/16	5 5/16	5 3/32	..	4 7 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	96 — 98	97 — 99	..	..	+1	3 10 8
1,983,593	Do. do. 4 % Deb. Stock Red.. ..	100	4 %	4 %	4 %	4 %	98 —100	98½—100½	99½	99½	+ ½	4 0 0
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	7 %	8 %	8 %	8 %	1 7/16— 1 11/16	1 7/16— 1 11/16	..	..	..	4 14 10
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	4 14 9
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87½	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7½ — 8	7½ — 8	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	98	..	..	4 10 0
3,042	Submarine Cables Trust..	Cert.	6 %	6 %	6 %	..	128 —131	129—132	..	..	+2	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6¾— 7 xd	6⅞— 7⅛	7⅛	7	+ ⅛	5 12 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 1/16— 5 3/16	5 1/16— 5 3/16	..	..	..	4 15 3
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1 15/16— 1 15/16	1 15/16— 1 15/16	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	7 %	13⅝— 14⅛	13¾— 14⅛	14 1/16	13¾	+ ⅛	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅝— ¾	32/32— 33/32	13/9	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	6 %	8¼— 9	8¼— 9	..	..	..	6 13 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	14½%	8 — 9	8 — 9	..	..	..	16 12 9
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	99 —101	99 —101	..	..	..	4 19 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	..	5 %	4 5/16— 4 9/16	4 5/16— 4 9/16	90/7½	87/-	..	5 9 7
500,000	Do. 5 % 2nd Pref., 800,000 to 1,300,000	5	..	..	..	5 %	4 5/16— 4 7/16	4½— 4⅝	..	..	— 1/16	5 14 3
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90 — 91½	90 — 91½	91½	90½	..	4 7 5
332,387	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
830,000	Babcock & Wilcox, 1 to 830,000	1	20 %	20 %	20 %	24 %	5⅜— 5⅝	5⅜— 5⅝	5 5/16	5⅜	..	4 7 8
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	3 19 0
1,000,000	British Aluminium 5 % Mort. Debs. Red.	100	..	..	..	..	..	..	..	..	..	5 9 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	140 —145	141 —146	..	..	+1	5 10 4
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	122 —126	122 —126	..	..	..	4 15 3
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	108 —110	108½—111½	111	109½	+1	4 9 8
233,000	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
133,301	British Electric Traction	10	Nil	Nil	Nil	Nil	½— 1	½— 1	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1½%	Nil	2⅜— 3⅛	2⅜— 3⅛	53/9	..	..	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	87 — 91	86 — 90	80½	86	—1	5 11 1
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	68 — 73	68 — 73	..	..	..	6 3 3
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6¾— 7¼	6¾— 7¼	7⅛	6 15/16	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5¾— 6¼ xd	5¾— 6¼	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	101 —104	101 —104	103½	..	..	4 6 7
204,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	5/16— 9/16	5/16— 9/16	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	61 — 63	61 — 63	..	..	..	6 7 0
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	Nil	0 — ⅜	0 — ⅜	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref... ..	2	Nil	Nil	Nil	Nil	0 — ⅜	0 — ⅜	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	23 — 27	23 — 27	..	..	..	16 13 3
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	4½%	4 — 4½	4 — 4½	..	..	..	5 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	5 %	5 %	5 %	5 %	4⅜— 4⅝	4⅜— 4⅝	..	..	..	5 1 3
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	10 %	9½— 10½	9½— 10½	..	..	..	4 17 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4½— 5½	4½— 5½	97/6	..	..	4 15 3
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅜— ⅝	⅜— ⅝	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	12½%	2⅝— 2¾	2½— 2⅝	..	..	+ 1/16	4 9 3
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107 xd	104 —107	..	..	..	4 4 1
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	66 — 68	66 — 68	67	..	..	4 8 3
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 12
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	49 — 51	49 — 51	..	..	..	3 18 5
1,480,000	City and South London Railway	Stock	2½%	2½%	1½%	1½%	27⅛— 28⅛ xd	27⅛— 28⅛	28¼	27½	..	6 2 10
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	5 %	Nil	Nil	¼— ⅜	¼— ⅜	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	84 — 87	84— 87	..	..	..	5 14 11

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Aug. 2nd.	Closing Quotations Aug. 9th.	Business done week ended Aug. 9th, 1910.		Rise + or Fall —	Present Yield per cent.
		*	1906.	1907.	1908.	1909.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	6 %	1 1/16 — 1 1/8	1 1/8 — 1 1/16	..	..	— 1/16	5 6 8
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1 1/8	1 — 1 1/8	..	..	..	5 6 8
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	2½%	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
17,139	Do. "A" shares, 01—017,139	5	4½%	2½%	Nil	Nil	1 — 1½	1 — 1½	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	63 — 68	63 — 68	..	..	..	5 17 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82	79 — 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	¼ — ⅜	¼ — ⅜	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1⅛ — 1⅛xd	1⅛ — 1⅛	..	..	..	9 6 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7⅞ — 8	7⅞ — 8	..	..	..	6 5 0
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 13 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	⅛%	Nil	Nil	⅜ — 1	⅜ — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10⅛ — 10⅜	10⅛ — 10⅜	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103½	102 —103½	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12 — 12½	12 — 12⅝	12⅝	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	4⅞ — 5⅛	4⅞ — 5⅛	5 3/32	98/9	..	4 5 9
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½%	4½%	4½%	4½%	104 —106	105 —107	..	..	+1	4 4 1
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	10 %	14½ — 15½	14⅝ — 15⅛	..	..	..	6 11 2
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	⅛%	Nil	Nil	¾ — 1	1 — 1 1/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	9 1 10
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	3 %	Nil	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
399,980	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3 1/32%	..	2 — 2⅛	2 — 2⅛	..	..	..	15 0 0
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 71	67 — 71	69⅛	68⅜	..	5 12 8
5,732,062	Metropolitan Consolidated	100	1 %	⅛%	⅛%	1 %	38½ — 39xd	37⅞ — 38⅛	38⅜	37⅞	— ⅜	2 12 4
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	2⅜%	65 — 67xd	65 —67	66⅛	65	..	4 2 1
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	20½ — 21	20 —20½	20⅜	20	— ⅛	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	11/16%	..	31/32 — 1	31/32 — 1	16/6	15/-	..	5 15 0
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	11/16 — 11/8	11/16 — 11/8	..	..	..	5 9 7
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	6 %	119 —121	118 —120	120½	118½	—1	5 0 0
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	..	5 %	5 %	98 — 99	99 —100	99⅝	98⅜	+1	5 0 0
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	⅛ — 3/16	⅛ — 3/16	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅛ — 3/16	⅛ — 3/16	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	82	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	33½ — 35½	33½ — 35½	35½	34⅛	..	5 18 8
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..	3 18 11
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	..	5 %	..	102⅜—103⅜	102⅜—103⅜	..	..	..	4 16 7
2,800,000	Do. do. 4½ % Bonds.	..	..	..	4½%	4½%	86 — 88	87 — 89	88	87	+1	5 1 2
4,900,000	Do. do. 6 % Income Bonds	..	..	..	..	..	36 — 38	37 — 39	39	36½	+1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	⅛ — ¼	⅛ — ¼	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	8 11 5
245,495	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	60 — 70	60 — 70	..	..	..	5 14 4

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	7¼ — 7⅜	7¼ — 7⅜	7 5/16	7⅜	— ⅛	6 11 2
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	7⅛	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3½ — 4	3½ — 4	76/10½	75/7½	..	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	4 16 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	73/9	..	..	4 17 0
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 2 6
49,436	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3¾ — 4¼	3¾ — 4¼	..	..	..	5 5 11
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11½ — 11⅝ xd	11½ — 11⅝	11 9/16	..	..	6 0 5
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅜ — 12½ xd	11⅜ — 12½	11 13/16	..	..	4 19 0
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	119 —123	120 —124	121	..	+1	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99½—102½	99½—102½	..	..	..	4 7 10
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1⅝ — 2	1⅝ — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅝ — 3¼	2⅝ — 3¼	..	..	..	7 13 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94½ — 96⅝	94½ — 96⅝	..	..	..	5 3 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅜ — 7⅝ xd	7⅜ — 7⅝	..	..	..	6 7 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11 xd	10½ — 11	10 5/8	10⅜	..	5 9 1
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	103¾—106½	104 —107	106¼	105⅛	+ ⅜	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	99 —102	100 —103	101⅛	101¼	+1	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	75 — 78	75 — 78	76	..	..	5 15 5
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	5 %	5 %	85 — 88	85 — 88	86¼	86	..	5 8 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	7 — 7⅛	7 — 7⅛	..	..	..	5 13 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	100 —102	100 —102	101½	..	..	4 18 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	7 — 7⅞	7 — 7⅞	..	..	..	5 6 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95 xd	93 — 95	..	..	..	4 4 3
11,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1⅝ — 2	1⅝ — 2	..	..	..	4 8 11
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	5 — 5⅛	5 1/16 — 5 5/16	5 5/32	5 3/32	+ 1/16	5 12 11
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½ %	4½%	4 %	4 %	90 — 92	90 — 92	..	..	..	4 7 7
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	3 — 3⅛	3⅛ — 3⅜	72/6	62/6	+ ¼	7 2 10
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4 — 4⅛	4 — 4⅛	86/3	77/6	..	5 0 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	82 — 85	82 — 85	..	..	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	85 — 86	85 — 86	85½	85¼	..	5 16 3
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	4 %	3½%	4 %	77 — 79	77 — 79	78¼	78	..	5 1 3
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	101 —103	101 —103	102⅜	102½	..	6 15 11
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	91½ — 92½ xd	92⅛ — 93⅛	93⅜	92⅜	+1	5 6 11
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95⅝ — 97½	95¼ — 97½	..	..	..	4 12 4
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	2½%	..	3½ — 4 xd	3¾ — 4⅛	..	..	..	2 19 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4¼ — 4⅜ xd	4¼ — 4⅜	..	..	..	5 5 3
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	..	5 %	100 —102	100 —102	..	..	..	4 18 0
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	12 — 13	12 — 13	..	..	..	5 7 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6⅛ — 7	6⅜ — 7⅛	..	..	— ⅛	5 1 10
119,694	River Plate Elcty. Co. Ord.	Stock	2½%	6 %	8 %	9 %	210— 225	210—225	218	..	..	4 0 4
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	6 %	105— 115	105—115	..	..	..	5 4 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	100½—102½	100½—102½	..	..	..	4 17 7
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	7⅜ — 8⅜ xd	7⅜ — 8¼	7⅝	..	— ⅛	6 1 3
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛ xd	6⅞ — 7⅛	..	..	..	4 16 7
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	84 — 86	84 — 86	..	..	..	4 1 5
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅛ — 2	1⅛ — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	8 %	4 %	5 %	5 %	2⅜ — 3⅛	2⅛ — 2⅜	55/-	..	— ⅛	6 15 7
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	99 —102	99 —102	101½	..	..	4 18 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	⅛ — ⅜	3/16 — 3/8	20/-	..	— 3/32	6 13 4
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	6 11 9
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	99	98	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	¾ — 1	¾ — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2½	2 — 2½	..	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	⅜ — ⅞	⅜ — ⅞	..	..	..	5 14 3
100,000	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8⅞ — 8⅞ xd	8⅞ — 8⅞	8⅞	8⅛	..	5 15 11
£1,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	4⅝ — 5⅛	5 — 5⅛	..	..	+ ⅛	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent. June 9th. 1910.

REVIEWS.

Analyse des Métaux par Electrolyse. Second Edition. By A. Hollard and L. Bertiaux. Paris : Dunod et Pinat. Price 9 fr. 50.

The first part of this book contains a general discussion of electrolytic analysis, including the theory of electrolysis, the influence of current density, the grouping of metals according to their behaviour on electrolysis, and general methods illustrated by details of complex separations. This part of the book will give those unacquainted with the subject a fair insight into the general principles of electrolysis as applied to analysis of metals. There are useful notes on types of electrodes and on general arrangements for the distribution of current.

Directions for the electrolytic determination of the commonly occurring metals, and for their separation by electrolysis, are given in the second part of the book, in which the metals are divided into two classes according as they can or cannot be deposited on platinum from a strongly acid solution. The application of the various methods to the analysis of the industrial metals and alloys is described in the third part of the book.

In the fourth part, numerous useful results of analyses are quoted, illustrating the accuracy which may be expected from electrolytic methods of determination.

Throughout the work the methods given are fully described, and anyone with a fair chemical knowledge and training in analytical manipulations should be able to understand and work the various separations.

The book is well written, and should be of assistance to the metallurgical chemist who wishes to adopt electrolytic methods of analysis.

Metallurgy of the Common Metals (Non-Ferrous). By A. Humboldt Sexton, F.I.C., F.C.S., and John S. G. Primrose, A.G.T.C., A.I.M.M., M.I.M. Manchester : The Scientific Publishing Co. Price 7s. 6d. net.

As stated in the preface, this book is intended as an introduction to the study of the metallurgy of the more common metals, excluding iron, and as such it is to be recommended. It contains a great deal of carefully selected information, it is well arranged, is clearly and concisely written, and appears to be free from errors, with the exception of a remark on page 2, line 6. Although the distillation of copper is not a commercial process, the statement that copper cannot be distilled is incorrect.

Roughly speaking, one-third of the book is devoted to the metallurgy of copper, and another third to that of lead, including the concentration of silver in lead by the Pattinson and Parkes process, whilst the remainder is concerned chiefly with tin and zinc, short chapters being given also on antimony, aluminium and nickel.

For each metal the authors give a good description of the physical properties, that for copper being illustrated by some excellent microphotographs showing the influence of impurities and of treatment on the structure of the metal. The minerals in which the metal occurs and their distribution are then described, some information exceedingly interesting to those unacquainted with the mining side of the subject being given, especially in the case of tin. Short accounts are given of the various processes by which each metal is obtained from its ores, suitable types of furnaces being discussed and illustrated. The wet methods and electrolytic processes of metallurgy also receive due consideration.

Amongst the chapters on copper there must be noted a lucid explanation of the principles underlying copper smelting, and a clear account of the application of electricity to the deposition and refining of the metal, and to the smelting of its ores.

In the account of the metallurgy of lead, which, considering the scope of the book, is very fully described, there is an excellent discussion of the treatment of these complex lead-zinc sulphides, such as the well-known Broken Hill ores of New South Wales, which still offer the metallurgist an unsolved problem.

The book is well illustrated throughout, and contains charts showing the rise and fall in the price of the metals. At the end tables are given of the physical constants of the metals, thermochemical data, and factors for calculating blast-furnace charges, the book concluding with a useful bibliography.

The Design of Condensing Plant. By F. W. Wright. London : The Technical Publishing Co., Ltd. Price 3s. 6d. net.

This excellent little book can certainly lay just claim to its sub-title, "A Practical Treatise," on a subject not previously treated exclusively in any book yet published, and the publishers are to be congratulated on adding yet another work to the number of practical text-books issued by them.

The author has collected together the mass of experimental data already published in the *Proceedings* of the various technical institutions, and arranged them, aided by his practical experience, in an order capable of ready reference and practical use.

Chapters are severally devoted to jet, ejector, surface and evaporative condensers, while the subjects of water cooling plant and air-pump efficiencies are likewise treated.

Quite a special feature of the book is the reduction of all the important formulæ to curves suited for quick reference, and in this direction full use of "logarithmic" squared paper has been made in order to reduce the curves to straight lines.

Scattered through the book are a number of actual designs, while illustrations of the "pretty picture" type have been carefully avoided.

We have noticed one or two slight slips and misprints, such as on page 53, line 7, "1 cb. ft. of surface to 10 lb. of steam," should, of course, read, "1 sq. ft. . . . . steam." The omission of "at," the second word in line 11 from the bottom of page 89, makes the sentence incorrect. Similarly, "thermo-dynamo" in line 2 from bottom of page 151, should read "thermo-dynamic." Printers' errors occur on page 85, bottom line ; in the title of fig. 82B, and on line 9 from the bottom of page 182.

Apart from these minor defects, the book is very well arranged, the printing and illustrations being all that could be expected in a book produced at its price. Most of the text refers only to land practice, although, of course, much that is said in the surface condenser section would apply equally well to marine work ; but the latter branch is generally dealt with fully in books specially devoted to marine engineering. We can confidently recommend the book to all students of engineering and to all those whose work is connected with the design or working of condensers. —C.A.S.

Thornton on Patents (British and Foreign). Being the pith of patent law and practice in the United Kingdom and abroad, with rules, forms, examples and precedents. By Alfred Augustus Thornton, consulting patent agent. London : Charles Jones, Ltd. Price 21s. net.

The title of this work might lead one to suppose that it is a new edition ; but it is not so. Unlike the authors who have published such great legal tomes as "Byles on Bills," "Scriven on Copyholds," and "Lumley's Public Health," &c., Mr. Thornton has declined to wait until such time as his work has run through several editions before incorporating his name with the title.

Perhaps this departure from precedent is justifiable when we read (as we do in the preface) that the work is not intended to compete with "more exhaustive and excellent works by various members of the bar." The fact that the work is not intended primarily for lawyers is something that will commend it to the layman.

A glance through the volume shows that it contains that which every patentee wants to have, namely, practical advice as to the steps which must be taken in order to obtain a patent. There are, and always will be, a large number of inventors who for varying reasons wish to deal with their own patent applications. The earlier chapters, together with the discussed examples in Chapter XIII, will at least enable them to draft their specifications in accordance with legal require-

ments. This Chapter XIII is a most useful piece of work. It sets forth model specifications for an invention wherein balls and rollers are combined. The diagrams, which are very similar to those which must accompany a specification, serve to explain the author's meaning more clearly than any quantity of letterpress. Mr. Thornton also points out how to get the full advantage of the official investigation. To do this "claims at the outset should be drawn so as to include analogous devices. If, for instance, a claim is at the outset made to a 'razor blade having two edges,' the official search need not extend beyond razors; but supposing a claim is in the first place made to 'a cutting instrument having two edges,' the examiners would include in their search all cutting tools. It is a point worth bearing in mind by those who want to eventually get sound claims."

In a chapter entitled "What every patentee ought to know" (Chapter XVI) Mr. Thornton gives the benefit of his experience in all those little matters with which the patent agent is, as a rule, alone familiar. Who, for instance, could have said off-hand that the Patent Office is open until midnight for the reception of certain matters? The remainder of Chapter XVI is devoted to forms. These are copies of the official printed forms filled in in the proper places, with fictitious names, &c. They cannot but prove useful to persons who, being unable to afford to pay fees to a patent agent, have to fill up these forms by themselves.

Part II of the work is not the least valuable portion. It contains a summary of the laws affecting foreign and Colonial patents. Here one may find a summary of the law of patents in the Argentine, Australia, Austria, Brazil, Belgium, Canada, Cape Colony, Ceylon, Chile, Denmark, Egypt, France, Germany, Hungary, India, Italy, Japan, Mexico, Natal, New Zealand, Norway, Orange River Colony, Portugal, Rhodesia, Roumania, Russia, Soudan, Spain, Sweden, Switzerland, Transvaal, Tunis, Turkey, United States. There are also foreign and Colonial forms with directions for signing the same in all the above countries, and in addition Bolivia, Columbia, Costa Rica, Cuba, Ecuador, Guatemala, Honduras, Luxembourg, Nicaragua, Panama, Peru, Salvador and Venezuela.

In addition to an excellent index, there is a folded table inside the back cover which serves as an immediate guide to the contents of the volume. We heartily commend it to those who are interested in, or affected by, the law of patents.

Elementary Electrical Calculations. By T. O'Conor Sloane. London: Crosby Lockwood & Son. Price 9s. net.

In the preface the author tells us that the book is designed to give in simple form what may be termed a foundation for the study of electrical calculations. The operations described require only an elementary knowledge of mathematics, for it is a feature of electrical science, that, although it is built up on a basis of mathematics, a great part of the engineering calculations is comprised within the limits of arithmetic, while elementary algebra carries it a long way further. Many people who would be frightened at the mere name of algebra, yet unconsciously use it in the form of an algebraical equation, each time they employ Ohm's law.

The whole book is of an elementary character, and is of the type that aims to teach the student by the calculation on his part of numerous examples. This is a system that every teacher will immediately acknowledge to be of great worth. Most of our English text-books, at any rate those of a semi-practical scientific nature, indulge in long descriptive work and put an example or two at the end of each chapter. This may be all right for the advanced student, but it is decidedly all wrong for the elementary. The reviewer has in mind text-books in various branches of technical work that are enormously used by students. These books are used because there are no better on the market and because their authors bear great names—not great names as teachers, however. An elementary student came to the reviewer a short time ago, and asked him almost with tears if he could recommend a text-book on such and such a subject, as the one he already had (bearing a great name, and being of the nature of an encyclopædia, absolutely without system throughout, and with no teaching ability displayed on a single one of its hundreds of pages) he could do nothing with. The reviewer, who has large experience of students and what they require, had to answer that there was nothing better to be had.

That students like worked-out examples, and plenty of them, is a well-known fact. As an instance of this, every teacher of steam knows the difficulty a student has in applying Regnault's formula for total heat. The reviewer has seen students, otherwise quite intelligent, after having it dinned into them for a session, come to grief over this simple matter. If the feed water is at some higher temperature than 32° F. (as is, of course, always the case except in the Arctic regions) the mixing up of the two initial temperatures causes shocking mischief. It is in such a case that the value of many examples bearing on the matter from all aspects is particularly apparent, and if, in addition, the teacher can hit upon any little device, such as using Regnault's formula for latent heat only, so much the better for his students.

The first three chapters in the volume under consideration have to do with arithmetical short cuts, algebraical symbols, coefficients, functions, the exponential notation, mechanics and physics. Such terms as velocity, acceleration, work, power, &c., are nicely defined and well illustrated with examples. Perhaps, with regard to force, it would be better to say it is that which can impart change of velocity to a mass, than simply velocity.

Chapter IV deals with Ohm's Law and its applications, and succeeding chapters with Resistance, Kirchhoff's Laws, Arrangement of Batteries, Electric Power and Energy, Bases and Relations of Electric Units, Thermo-electricity, Electro-chemistry, Fields of Force, Magnetism, Electro-magnetic Induction, Capacity and Inductance, Hysteresis, Alternating Currents and Networks.

The treatment of all these subjects is such as to call for the use of no more algebra than is involved in the treatment of Ohm's Law. Complex variable and graphic solutions of alternating-current problems are not employed, as they are outside the scope of the book.

In the appendix some illustrations of geometric, of more advanced algebraic, and of simple calculus solutions, are given, which may be of interest to those who have some acquaintance with higher mathematics. In our opinion, however, the appendix could have been omitted with advantage.

The book is essentially one of examples and solutions, and is, therefore, we know from experience, the very one likely to find favour with students.

The Law and Practice of Rating and Assessment. A handbook for overseers, members of Assessment Committees, surveyors and others interested in rating and valuation. By Clarence A. Webb. London: Crosby Lockwood and Son.

This volume (according to the preface) is intended to give in as concise a manner as possible both the law and practice relating to the rating and assessment of the various kinds of properties with which Assessment Committees have to deal. The author hopes that the book will also be of assistance to occupiers and owners of rateable property, and to officers of public companies, &c., who are interested in rating matters, as well as to municipal officers, students and candidates for membership of the Surveyors' Institution and the Auctioneers' Institute.

An examination of Mr. Webb's pages leads one to think that his hope will be realised. In that extensive domain which is covered by the word "Rating," the surveyor comes first and the lawyer second. Here we have an exposition of the subject from the practical point of view. Part I deals with the law of rating under the sub-heads: "General Principles," "Exemptions from Rating," "Rating of Owners" and "Collection and Enforcement of Rates." In Part II there is a description of the rating powers of local authorities, both within and without the metropolis. Part III describes the making and correction of valuation lists; while

Part IV describes the methods which must be adopted in the valuation of various kinds of property. In this part we find one chapter (Chapter XV) devoted to Electricity Supply Undertakings — Gas Companies' Undertakings — Water Supply Undertakings and Tramways.

It is to this chapter that one who is reviewing Mr. Webb's treatise for an electrical paper will turn his most critical eye. As Mr. Webb very properly points out in his preface, "to fully follow the method of rating an electricity undertaking it is necessary also to consult the chapter on the rating of railways." This is, indeed, a useful reminder. Indeed, it might be said that if one thoroughly understands the method of rating any class of property, one is provided with a clue to the rating of all property. You have to conjure up that visionary creature—the hypothetical tenant: find out what rent he would pay; make certain statutory deductions from that rent; and there you are! But it is no easy task to imagine the existence of a tenant of an electrical undertaking. It is the practical man, like Mr. Webb, who can bring him into being and determine the rent which he would pay to the nearest penny.

Elsewhere in the book we find a useful chapter on the Rating of Machinery. As manufacturers know to their cost, loose machinery has in effect been brought into rating in recent years. The author sets out the effect of all the recent decisions, and describes the practice with regard to rating machinery which is followed in various parts of the country.

The work has a good index, and should prove most useful to those who, at a time when all the property in London is being revalued, are anxious to have their rates reduced.

THE UNIVERSITY OF SHEFFIELD.

By C. ALFRED SMITH, M.Sc., A.M.Inst.E.E.

When Mr. Joseph Chamberlain suggested to the citizens of Birmingham that they should subscribe money and apply to the Privy Council for a University charter he commenced a crusade which immediately affected technological education throughout England. In the year 1900 there were University Colleges at Birmingham, Manchester, Liverpool, Leeds, Sheffield and Bristol. To-day—in less than ten years—each of these centres of industry has its own University. Everyone of them has greatly improved its equipment for instruction and research work in technology—most of them have utterly transformed the departments of applied science as a result of the increased status and financial resources gained by the zeal of those who followed the lead of Birmingham's first Chancellor.

Electrical engineers fully realise the significance of the new state of affairs. By a very happy arrangement the local sections of the I.E.E. are closely connected with the civic universities. Of all branches of engineering, that which deals with electricity is the most progressive and the least dependent upon rule-of-thumb methods. The brilliant mathematical student seems instinctively to select electrical technology before other applied science subjects. The borderland between the physicist and the electrical engineer is narrowed until it almost disappears. In a comparatively new subject, so dependent upon theory and experiments for its progress, research work grows in volume, and each new discovery points, as a finger, to a hundred others. The union of theory and practice is possible and obtains in a manner not yet realised in other engineering work. A glance at the list of Presidents of the I.E.E. proves that the college professor is not shunned by the practical man. This year Dr. Gisbert Kapp occupies the chair in which Lord Kelvin, Profs. Foster, Adams, Ayrton, Silvanus Thompson, Perry, and Dr. Glazebrook have worked so ably, with such dignity and for the good of the profession. It is therefore not surprising that electrical engineers should watch with keen interest the astonishing development of the new Universities, each of which has seized hold of Mr. Chamberlain's ideal and has determined to "specialise in accordance with modern conditions, and the particular needs of the district for whose benefit it is established," and so enable us to "prepare ourselves for the great struggle with our rivals which is inevitable." The days, which some of us can remember too well, when electrical engineering was tacked on to the physics department as a subsidiary subject, and when experimental work was done with toy apparatus, are gone for ever. The old order has changed giving place to the new.

Some time ago the writer visited the two Yorkshire Universities situated at Sheffield and Leeds. Both places have this much in common—they have greatly extended their departments of Applied Science. In Leeds the thing which impressed me most was the department called "gas engineering, fuel and metallurgy," not because it was the largest, for the textile industry seems to have claimed that honour, nor because more money had been spent on the equipment, for the electrical engineering and other laboratories probably cost more. It was the coming of the subject "Gas Engineering" into a University syllabus that forced its attention upon my mind. The Institution of Gas Engineers have, in a most practical fashion, given their official support to this venture. Read how the *Journal of Gas Lighting** regards the matter. "The next few years," it says, "will be critical ones, both for the new department and for the gas industry at large. The former is now definitely introduced to the profession, is being officially recognised and assisted by it, and its work will be watched with close interest. On the other hand, the offer of these advantages serves as a touchstone by which the gas industry will be tested; and on the results of that silent, almost unnoticed, test, large issues will depend. . . . At the beginning of the second century of its history the Gas Engineering profession has the initial offer of similar University advantages to those enjoyed by the rival profession. . . . It should not be forgotten that the Government devotes a fund of £100,000 annually in aid of University work. To this fund the gas industry has contributed in the shape of income-tax paid on its profits; and, therefore, on the lowest grounds of self-interest, it should take care to duly participate in the benefits of modern university developments." Which shows quite clearly that the gas engineers are waking up to the fact that "the rival profession" (electrical engineering) has forged keen weapons for the struggle in college laboratories. So much for Leeds, which also possesses a completely equipped and admirably designed building entirely devoted to teaching and research work in electrical engineering.

Sheffield, to most civilised people, means steel. Therefore, the University authorities have wisely made the equipment of the metallurgical department more unique than that of the other branches of the applied science faculty. But they have by no means starved mechanical and electrical engineering. Sir Frederick Mappin, M.P., is chairman of an advisory committee for this faculty. On the staff the best known names are Profs. W. Ripper, J. O. Arnold and A. McWilliam.

Of especial interest to electrical engineers are the pyrometers and electrical furnaces in the metallurgical department. One of the merchant princes of Sheffield—when will the London merchant princes follow this lead from the provinces?—purchased and presented to the University a steel works, in which has been installed the most up-to-date equipment. This consists of large steel-making furnaces—one of 2-tons capacity. A Kjellin electric steel furnace is a most important feature. Prof. McWilliam recently told the audience at an Iron and Steel Institute meeting that Sheffield was very much alive to the importance of this aspect of steel making, and the University authorities are not only watching closely all countries, but are gaining practical experience and testing for themselves. You may see in this University steelworks, an electro-pneumatic

* December 17th, 1907.

hammer (7 cwt.) capable of taking sizes up to 4 in. sq. The whole of the department is worked electrically, "so that economy of space is possible," significantly adds the official souvenir of the University. Two-phase current is supplied by the City Corporation. In one bay of the steelworks there is a 4-ton travelling crane. In the foundry there is a 4-ton three-motor crane, while the horse-power of the motors in the metallurgical laboratory is 150. In the special alternating stress apparatus, designed by Prof. Arnold, the energy necessary to produce rupture is measured by a delicate integrating wattmeter. The micrographic installation, consisting of a battery of six 4-in. polishing blocks, is driven electrically by a 1-H.P. motor. A powerful Nernst lamp illuminates the Zeiss photo-micrographic apparatus. All of the well-known and most perfected electrical pyrometers are installed. In connection with the central station Le Chatelier installation, is a furnace for measuring recalescence *in vacuo*, together with a keyboard and an electric chronographic recorder. This Le Chatelier pyrometer can be connected by means of a switchboard to any of the practical or laboratory furnaces.

Power is supplied to the applied science laboratories, situated in the main building, from some machinery situated in the heat engine laboratory. There is a 35-KW. two-phase Fuller-Wenstrom alternator, which is direct-coupled to a compound steam engine of the vertical marine type. The horse-power of the engine is about 50, and it is fitted with a surface condenser, and drives its own air pump. There is a Parsons steam turbine which is direct-coupled to a two-phase alternator of 25 KW. capacity. An independently-driven two-phase motor of 1 H.P. drives the air pump. A De Laval steam turbine of about 14 H.P. is arranged to drive a three-phase alternator. Other steam engines used for testing are a horizontal engine (with two high-pressure cylinders, single acting, specially designed to work with highly superheated steam, a small single cylinder vertical engine (provided with three slide valves of different laps, &c., for experimental work) and a single cylinder vertical engine.

A three-cylinder vertical Westinghouse gas engine of 35 B.H.P., fitted with electric ignition, is direct-coupled to a 25-KW. continuous-current generator, two Stockport gas engines of 14 H.P.—one of which drives the workshops and the other a three-phase generator, are provided. There is also a Hornsby-Ackroyd oil engine and a 40-H.P. Ingersoll-Sergeant two-stage air compressor, driven from the town mains by an alternating-current motor.

The electrical equipment also contains two 10-KW. motor-driven three-phase alternators, 220-volts and 50 frequency; two 15-H.P. compound continuous-current motors; two three-phase rotaries, 220 volts, 50 frequency; one rotary for single, two and three-phase currents; three experimental D.C. generators driven by two and three-phase motors, and a number of small single-phase and polyphase motors.

In the transformer gallery equipment is noticed an attempt to show the general principles of sub-station practice. There are 16 transformers, among which are a set for changing two-phase to three-phase, and *vice versa*. To the 12 marble panels of the switchboard are fitted all the instruments and switchgear, so that each set of machines has its own panel and instruments.

The polyphase plant demonstrates power station practice, and has been arranged for parallel running, it shows the methods of changing phase and the use of rotaries.

There are well-equipped laboratories for the purpose of experiments in elementary mechanics, magnetism and electricity, &c.

One of the most interesting features of the engineering equipment is a large lathe, the main shaft of which is driven by a 45-E.H.P. motor, and the feed shaft by a 5-E.H.P. motor. A special rotary and switchboard has been installed for this tool. A number of experiments upon the life of tool-steel will be made. An electrically-driven drill is also a feature of interest to electrical engineers. This brief outline will enable the reader to form some notion of the progressive spirit which animates this University. That the prosperity of the whole of Yorkshire, and even the adjoining counties, will be affected by the work done at Sheffield and Leeds Universities, cannot be doubted. May they prosper and continue to be supported by the local men of business talent and resources.

INQUIRIES AND SPECIFICATIONS.

[COMMUNICATED.]

The eagerness with which manufacturers have to compete for orders has led to a form of abuse which has become a real evil in the system of quoting for work. At the present time, prices for work are being augmented by the fact that the cost of estimating for, and quoting against, multitudinous specifications absorb such a large amount of the time of a highly-trained staff, that either the firm has to do the work at no margin—which, cannot, of course, continue indefinitely—or there is of necessity a general increase of price. Frequently there is more money spent in preparing specifications, sending out inquiries which are tendered and sub-tendered to again and again, than there are profits made out of the actual transactions. The question is a difficult one, but as matters now stand both buyer and seller are placed in an absolutely fatuous position. It may do some good, however, if the subject is opened for discussion in order to obtain some consensus of opinion as to the best means—if any—of dealing with it. The question applies to the whole range of specifications which are now being, and have been, issued, which do not deal simply with a single item, or set of items, which can be supplied by one manufacturer direct from the works, but which include a series of goods made by more than one manufacturer. Consulting engineers, for example, when preparing specifications for the equipment of power stations, sub-stations, and other parts of a generating and transmission system have a tendency to put switchgear in the same specification as that which describes the dynamos and motors, the object being to save themselves trouble by letting the whole contract to one firm. The simplicity of this arrangement, however, is more apparent than real, as in the majority of cases the firms which tender for the work, if they are builders of heavy machinery, do not build the switchgear, with the result that the switchgear manufacturers are in turn burdened with inquiries for their goods from a whole series of larger plant makers, all of whom wish to secure the contract, and the final selection which is made by the consulting engineer may very possibly include a considerable number of alternatives, the technical features of which he is not exactly in a position to determine. It would matter less if the consulting engineer were the only one to be worried by this plethora of quotations, but, as illustrated above, the system is contrary to the interest of the user.

There would perhaps not be such urgent need to complain of this series of inquiries if there was a fair chance of satisfactory business resulting from it, but it is easily seen that such a system wastes a tremendous amount of time in estimating costs. Following the argument along the lines of the example indicated above, each plant maker who does not make his own switchgear will, on receipt of the specification, send his inquiry to several switchboard makers, and by the time prices reach the actual user they are often so cut that the possibility of including good work at a fair profit is quite outside the question. In addition to that, the estimates which are sent in as the result of this sub-inquiring are not always the same in technical detail, with the result that quite unknown to the buyer there may be vast difference in ultimate results contained in the various prices which he has to consider. Moreover, it is in the end disadvantageous to the buyer to have, say, a dozen sets of estimators working on one set of conditions; as spreading the result over, say, a year's work for the whole industry, it is obvious that approximately 90 per cent. of the estimating work done at present goes to waste. The evil is aggravated by the fact that contractors very often, in sending round their inquiries to sub-contractors, alter the specification to suit their own idea of the tender, so that it is not always possible for the sub-contractor to prepare all his quotations in duplicate. He has to prepare several separate tenders for the same piece of work, each one being perhaps different in some small respect, and this not only adds to the work but increases the risk of error. The sum total of all this complication can be given in the one word—waste.

Yet another unpleasant feature of this system as that it is not unknown for a contractor who proposes to tender to an inquiry for part of which he must obtain a sub-contractor, to attempt to so disguise the inquiry (particularly if some special make of apparatus is specified) that the sub-contractor will not know for what work his sub-contract is ultimately intended. In some cases it is quite possible where a certain manufacture of goods is specified, that a contractor will do his best to get an alternative considered. He may fail in his attempt to do this, and yet in the event of his securing the work and having to install the particular make of apparatus which he has been fighting, he will still draw his profit from the manufacturer of the specified apparatus. Obviously in such cases he has done nothing to earn the commission, and the user is paying the contractor for his failure to substitute another apparatus for that which the user wanted.

Another feature which complicates the question, is that not only does the consulting engineer crowd a large number of different requirements into one specification owing principally to the fear of leaving some important item out in the process of preparation under various headings, but there is also the important consideration that very often large buyers, such as municipal corporations, and even private firms, prefer to limit their dealings over a contract with one large firm rather than to have to negotiate with several smaller contractors for the particular sections under which such contracts might be placed. The arguments on the side of either procedure are fairly well balanced. On the one hand, if one large contractor does the work, there is less probability of friction between the various men carrying out the different portions of the contract, and more probability that the whole work will be carried out with smoothness, and up to the time allowed. On the other hand, however, there is the important fact that the engineering industry is nowadays so specialised that it is possible for a firm to exist on the supply of one particular article provided that it is fairly treated, and a good many such firms are in a sufficiently important position to refrain from tendering as sub-contractors to a scheme which will leave them with very little or no profit. In this way the user of apparatus loses the benefit of the best that his money can buy, and this would seem to considerably out-weigh the arguments on the other side, bearing in mind that the consulting engineer, in order to be worth his money, should be capable of preventing anything confusing being embodied in his specifications, and the users should be induced to employ competent engineers to watch matters in their interests. It will very often be found that a little extra capital put into the erection of an engineering scheme in the way of specialised manufactures and skilled supervision in erection, will save an immense amount of money in running costs.

It cannot be too strongly insisted upon that, as already pointed out, the present system makes the user pay more money for the apparatus which he requires than he would do if this system of sub-tendering was restricted.

In further considering the question, so far as it applies to the plant equipment of an electricity generating and transmission scheme, it will be seen that the contracts as a rule can be very easily classified into definite headings, corresponding to the main lines upon which manufacturers in each sphere of engineering are divided. For example, it will generally be found that engineering contractors for power houses and sub-stations can be divided into the following classifications: foundations and building construction, engines, steam pipes, condensers, &c., dynamos and auxiliary motors, switchgear and accessories, and cables. With regard to such things as meters and instruments which are mounted on the switchboard, it will generally be found that switch makers have contracts with instrument makers, and this section of the work would be dealt with in exactly the same way as vacuum and pressure gauges would be dealt with by the engine makers. Now, if consulting engineers or users of electrical machinery could split up their scheme into sections, such as described above, corresponding to the actual manufactures along which firms at the present time specialise, it will be seen that an opportunity will be offered for every firm to put in a tender for the work which they could do, as contractors, and not sub-contractors, and, apart from the question of submitting alternative schemes, if sufficient latitude is allowed, there will in this case be only one set of estimates from each firm for the work required. This diminution of labour in what is not a profit-making department, will be, without doubt, very much appreciated by all engineering firms who can see their way to a realisation of the position.

It is an extremely difficult thing, however, to know how to set about securing a remedy of the evil, although we can see the evil itself. In the first place, there are some large firms whose influence is extremely important who might possibly object to the sectionalising of specifications, and who would uphold the principle of letting the contract as a single unit, simply because they have for years been developing along the lines, not of specialists, but of general suppliers. Any trend towards following the general tendency towards sectionalisation in a specification might be opposed by the more short-sighted of such firms. We use the term short-sighted advisedly, because the majority of large firms are so departmentalised that the massing of a specification into an unsectionalised group of requirements means that someone of prime experience and ability must be employed to disentangle the various items of work and to so arrange the operations of each department that harmonious working can be obtained. As a matter of fact, the cost entailed to a large firm in dealing with a confused specification is no less, even if everything is made and erected by its own workmen than if it had to solicit inquiries and get the work done from outside. It would be very much to the advantage in the long run of the large firms if specifications were so arranged that sub-contracting did not become inevitable. At the same time the electrical engineering industry is by no means at the mercy of such huge aggregations, although if this system is allowed to continue there is no saying at what date the smaller firms will be crushed out. At the present time, happily, there is still some opportunity for the considerable number of specialised industries to make some move in the matter, and it is probable that the best direction in which this could be made is an expression of opinion by the large number of manufacturers interested, which might probably produce desirable results in the minds of both users and consulting engineers. The practical outcome of such an attitude would be that specialised industries, if they could be bonded together in a sufficiently strong compact, could avoid tendering as sub-contractors to a specification, but at the same time would be able to express their willingness to submit direct tenders to consulting engineers or users. Such a position would probably lead to temporary complications, as there would naturally be a clash of interests, but in the end it is not probable that the specialists would lose. In any event in those cases where inquiries are circulated wholesale as at present, the firm that does happen to get the order will probably find that it has got the order because it happened to make the biggest mistake in preparing its tender.

Without some form of machinery to carry the above recommendation into effect, it would be useless to attempt to make any move in the matter, and it is fortunate that there is at present constituted a body which, if it can be persuaded to take united and strong action, would probably find itself in a position to bring the evil down to, at any rate, moderate dimensions.

The National Electrical Manufacturers' Association has already proved itself of great utility and value to its members. It would appear that no more suitable body could be found to deal with the matter. As, however, the Association is in no way responsible for the individual policy of a firm, there would be no advantage in such an Association taking steps in the matter, until it was reasonably certain that the general body of electrical manufacturing interests were in favour of such a movement. Nor is the discussion limited only to the manufacturing interests, as they, after all, are but a means to an end, namely, the satisfaction of the actual user. The ultimate object of such alteration, as is suggested in the above paragraphs, is the more complete security of the users' interests, and, therefore, an expression of opinion from the actual users of plant would be welcomed, inasmuch as it is obvious that any diminution of waste in the process of tendering benefits both the user and contractor. It is for the purpose of opening a discussion upon the question in our columns that we have laid the case at some length before our

readers in the foregoing paragraphs, and we think that time and space could be very usefully employed in setting forth the opinions of such manufacturers as have felt the pressure of this unremunerative form of labour.

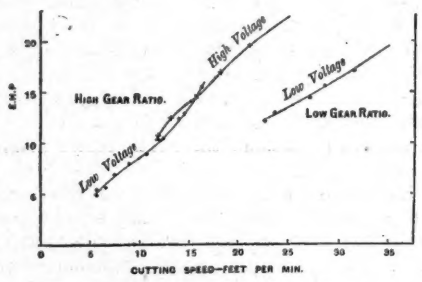
PROCEEDINGS OF INSTITUTIONS.

High-Speed Tools.

At the Birmingham meeting of the Institution of Mechanical Engineers, Mr. H. I. Brackenbury read an interesting paper on the use of high-speed tool steel, which indirectly emphasised the importance of the electrical drive in this connection.

Where full use is made of modern machinery with high-speed steel tools, the production, so far as roughing-out is concerned, is three times what it was under the old conditions. This means that the machines, the space occupied, the operators, shafting and supervision are all reduced in a like ratio, and although the power required to drive the machines is very large, the energy absorbed per lb. of metal removed is less than with low-speed machines.

Many of the old English-made machines are quite heavy enough to be used with high-speed steel, with slight modifications. The driving power must be increased in a ratio generally in the neighbourhood of 1 : 3 or 1 : 5 ; but in some cases, lathes formerly taking



Inefficiency of High Gear Ratio.

about 5 h.p. have been run up to 50 or 60 h.p., and a milling machine capable of removing 1,400 lb. of steel per hour consumes no less than 92 h.p.

The stepped cone is becoming obsolete, speed changes being effected by means of sliding gears in medium-sized machines, and variable-speed motors in the larger sizes. Such motors, on a d.c. three-wire system, give a wide range of speed, but the author points out that at certain speeds with light cuts the efficiency of the motor and machine may be far from good. This is exemplified by tests of a large lathe cutting 0·2 × 0·2 in. on 40-ton tensile steel, as illustrated herewith ; there is a drop in efficiency on changing from low voltage with a low gear ratio to high voltage with high gear, so that the same power was consumed when cutting at 18 and at 33 ft. per minute. The motor was rated at 40 h.p. on the high voltage, and was therefore underloaded, the cut being a light one. The inference is that heavy lathes which have to do both light and heavy turning should have the gear ratio arranged so that the full range of speed can be obtained on either voltage, and the builders should give the total efficiency of the lathe and motor at various speeds and loads. The facility with which the efficiency can be determined when the electric drive is used is well illustrated in this example, and in an instance described by the author, in which the defects of gearing temporarily repaired were conspicuously revealed by an ammeter.

Standardisation of Fuses.

By H. W. Kefford, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, May 25th*, 1910.)

The author refers to an editorial in the Electrical Review so long ago as 1905, pointing out the importance of standardising low-pressure fuses, and emphasises the importance of simplicity and reliability in every detail of the electric circuit, in order to create and maintain confidence in the public mind. In addition, the standardisation of fuses would conduce to economy in manufacture and reduction of cost. Many types in common use are wholly inadequate, and others needlessly elaborate. The complete specification of a line of fuses should embrace :—

(*a*) A definition of the "marked" or "rated" current in terms of the "limiting" current (also called the "normal fusing" current).

(*b*) A standard range of rated-current values and voltages.

(*c*) A definition of one or more points on the "time-overload" curve of each fuse.

(*d*) Regulations as to non-interchangeability, temperature rise, freedom from deterioration, and perfect operation under all conditions.

(*e*) Specifications for the standard method of carrying out short circuit, temperature rise, and overload tests.

The limiting current is the minimum steady current which will produce fusion after an infinite time interval, or for practical purposes, say, four hours. A fuse which is rated at R amperes must fuse within four hours when carrying a times its rated current, but must be capable of carrying $a - x$ times its rated current for at least four hours without fusing. If L amperes is the limiting current, the rated current R amperes must lie between L/a and $L/a - x$.

The Wiring Rules of the Institution require that no fuse shall carry more than 200 per cent. overload without fusing (*i.e.*, $a = 3{\cdot}0$), whereas the rules of another recognised authority in this country restrict the permissible overload to 50 per cent. ($a = 1{\cdot}5$). The regulations for enclosed fuses by the Underwriters' Association in the United States, framed with the co-operation of manufacturers, fix the values of a and $a - x$ at 1·25 and 1·10 respectively, but these figures were only decided upon after manufacturers had endeavoured to work to a smaller value of x than 0·15.

In Table I a few of the author's experimental results obtained with various makes of fuses are given :—

TABLE I.

Symbol of fuse.	Rated current.	Rated maximum voltage.	Ratio. Limiting current / rated current: $a-x$ minimum.	Ratio. Limiting current / rated current: a maximum.	Voltage drop at: Rated current.	Voltage drop at: Rated current × $a-x$.	Watts lost at: Rated current.	Watts lost at: Rated current × $a-x$.
P_1	4	500	1·25	1·50	0·572	0·830	2·290	4·15
P_5	50	500	1·00	1·16	0·277	0·277	13·870	13·87
Q_1	4	250	1·63	1·75	0·288	0·740	1·150	4·44
Q_{10}	50	500	1·40	1·60	0·224	0·321	11·200	19·26
R_1	4	550	0·75	1·00	—	0·958	—	2·87*
R_5	50	550	1·60	1·70	0·111	0·265	5·560	21·21*
S_1	4	250	1·50	1·75	0·082	0·153	0·328	8·20†
S_5	50	500	1·40	1·60	0·109	0·151	5·450	9·06†
T_1	6	250	2·67	3·00	0·078	0·563	0·466	9·01‡
T_4	50	600	2·00	2·20	0·114	0·464	5·680	45·95§
V_1	5	500	1·00	1·40	0·647	0·647	2·590	2·59
V_5	50	250	1·40	1·56	0·220	0·367	11·000	22·04
W_1	6	250	2·00	2·33	0·122	0·634	0·729	7·61
W_4	30	250	1·43	1·60	0·323	1·048	9·040	45·00
X_2	50	500	1·00	1·20	0·948	0·948	47·380	47·38‖

* Dangerous on short-circuit ; case burnt on overload. † Case burnt on short-circuit and overload tests. ‡ Behaved irregularly on overload. § Solder melted on overload ; holder burnt. ‖ Ran very hot.

The voltage drop is approximately proportional to the inverse square root of the limiting current ; and, therefore, the same value of A is not advisable for large and small fuses ; it may be desirable to increase the value of A as the normal working current diminishes. In the case of fuses of the totally enclosed type, the cooling facilities and the capacity for heat of the enclosure are greater, so that the size of wire for a given limiting current is reduced, and the drop of volts may be increased if the length of the fuse is not reduced ; on the other hand, if the fuse is very short, the terminals conduct heat away, and thus in order to keep down the drop the smaller fuses must be rated at a lower percentage of the limiting

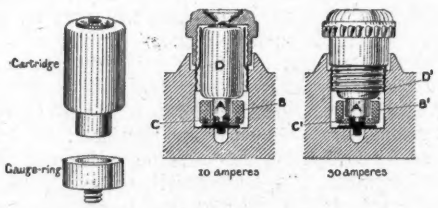


Fig. 1.—Example of Non-interchangeable Fuse System.

current. This should not be done with the larger sizes, as it involves the use of an unnecessary large volume of metal. Copper and silver are the only metals suitable for standardised fuses, and the minimum values of the ratio limiting current ; rated current with these are respectively 2·00 and 1·43, as they oxidise at normal load with lower values.

Some fuses consist of wire soldered to terminal plates, and on overload the solder melts, setting up an arc ; other fuses, of soft fusible metal, totally enclosed, explode violently on short circuit. It is essential that exposed wires and terminals be abolished in fuses for domestic use, and that the fuses be non-interchangeable, to ensure that a blown fuse shall not be replaced by one of larger capacity. These conditions are fulfilled by the fuse illustrated in fig. 1.

The loose pieces or "gauge-rings" B, B_1 consist of a steatite ring of constant external diameter, but having the diameter of the hole varying with the rated current. One of the terminals with which the cartridges D, D_1 make contact is situated at the bottom of the cylindrical hole in the steatite ring, and unless the stud A, A_1 is of equal diameter or smaller than this cylindrical hole, contact cannot be made. Thus B and D are gauge-ring and cartridge for 10 amperes, whilst B_1 and D_1 are the corresponding parts for 30 amperes rated current. The rings B for all capacities, screw interchangeably into

the same terminal block, but it is evident that a cartridge D_1 for 30 amperes will not make contact through its stud A_1 with the terminal C which lies at the bottom of a ring B for 10 amperes. It is, in fact, impossible to insert D_1 in a fuse fitting containing a gauge ring B of smaller capacity. Each rated current has its own special diameter of stud and gauge-ring orifice.

Bare wire fuses, or rather fuse fittings, in which a conductor can be easily inserted by the user, are incompatible with protection against overloading. Two other objections of equal weight against exposed fuse wire are their liability to scatter molten or hot metal, and the rapidity of corrosion unless certain non-active metals are used.

The principal objections raised against enclosed fuses are mainly questions of cost, the impossibility of inspecting the fuse wire, and the difficulty of ascertaining with certainty when the fuse has blown.

The deficiency of enclosed-type fuses in not giving reliable indication of fusion is a mechanical detail, which can be quite satisfactorily solved, as is shown in fig. 2.

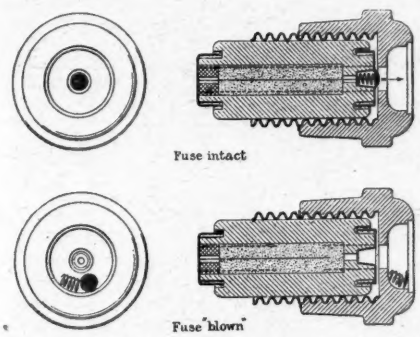


Fig. 2.—Example of Cartridge Fuse with "Self-Testing" Indicator.

Stress may be laid on four points essential to the satisfactory operation of any fuse:—

1. The volume of fusible metal should be reduced to the minimum compatible with correct rating and moderate temperature rise.

2. The fusible metal should be subdivided so that the ratio of exposed surface to cross-section does not fall below a figure depending on the design.

3. The provision of cooling arrangements adequate to extinguish the arc formed on overload.

4. In exposed wire fuses, the provision of sufficiently free expansion space to prevent explosion when a short circuit occurs. In enclosed fuses the same end must be attained by precisely opposite means, and no opening or weakness of any kind is permissible in the enclosing case.

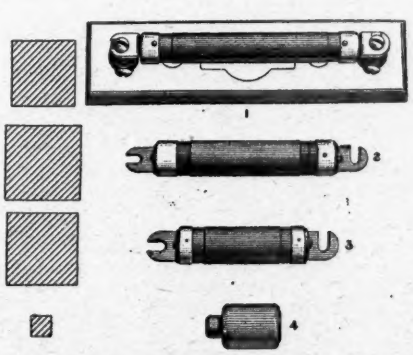


Fig. 3.—Comparison between Four Enclosed Fuses Rated at 50 Amperes, 500 Volts.

Fig. 3 shows four different makes of fuses, all for a rated current of 50 amperes, 500 volts, and all to the same scale. The square at the side of each fuse represents by its area the volume of fusible metal in the respective casing.

While the fuse (No. 4) containing the least volume of metal operated perfectly under all overload and short-circuit conditions, and the fuse (No. 1) which contains the next smallest volume of metal, and has a proportionately large casing, also behaved satisfactorily, the two remaining samples consistently exploded or burnt, often under the mildest circumstances. The great difference in the length of the four fuses is very marked, and the standard of excellence attained by each shows quite conclusively that attention to the four points enumerated above is necessary and sufficient for the production of a satisfactory article.

It is interesting to notice how the fulfilment of requirement (2) naturally leads to the cartridge design of fuse, since only in this design can the proper subdivision of the fuse wire be guaranteed. The use of soft metals such as tin, lead, or zinc is to be deprecated, although with very careful design successful use may be made of the non-arcing property of the last-named metals. The most important tests which a fuse must pass are three in number:—

1. An insulation or pressure test (*a*) between all live metal parts and earthed metal parts, (*b*) between the two opposite poles of the fitting when no fuse is in place and when a blown fuse is inserted.

2. Tests for operation with gradually increasing current at normal voltage until fusion occurs.

3. Short-circuit tests at normal voltage.

In addition to the above tests measurements should be made of the temperature rise of accessible parts of the fitting, and of the voltage dropped. A pressure test of at least 1,000 volts above the working pressure should be withstood without breakdown. Test 2 is of extreme value as an indication of the behaviour of the fuse under the conditions which in practice most frequently lead up to fusion. The formation of a continuous arc after fusion is even more dangerous than faulty performance under short-circuit conditions. It is surprising how large a percentage of sample fuses utterly fail under this test.

The value of a short-circuit test depends to a large degree upon the manner in which the term "short circuit" is interpreted. A suitable test for fuses up to 50 amperes rating is made with a battery having an open circuit voltage 10 per cent. higher than the rated voltage of the fuse, and capable of giving 500 amperes with 5 per cent. pressure drop, the total resistance of the circuit allowing a steady current of 1,500 amperes to flow. On closing the switch the fuse should blow without arcing or explosion.

The following suggestions are put forward as a basis for the discussion of a specification for standard fuses:—

1. (*a*) *Material for Fuse Wire.*—The fuse wire must not corrode or permanently change its conductivity or physical structure.

(*b*) *Non-interchangeability.*—Fuses up to 50 amperes rated current should be provided with a simple arrangement by means of which the capacity of the fuse which can be inserted by a non-technical user is restricted within definite limits.

(*c*) *Type of Fuse Recommended.*—To facilitate compliance with (*a*) and (*b*) above and generally to render standardisation practicable and useful an enclosed cartridge type of fuse is recommended.

(*d*) *Indication of Fusion.*—All fuses must be provided with a simple means for detecting fusion simply by inspection of the fitting.

2. (*e*) *Rating.*—The rated current marked on the fuse shall bear a definite relation to the limiting current or least current which will produce fusion within four hours. The minimum value of the ratio $a = \frac{\text{limiting current}}{\text{rated current}}$ shall be 1·54 and the maximum value shall not be higher than 30 per cent. above the minimum. In a correctly proportioned line of fuses, *a* should decrease from the maximum to the minimum values specified, as the size of the fuse increases from the lowest to the highest capacity. This regulation is based on the assumption that silver is the best metal for fusible links, taking into consideration its permanent character, the small volume required, and its "clean" action when breaking the circuit.

(*f*) *Sluggishness of Action and Time Element.*—Standard fuses shall be so rated and constructed that when loaded with 50 per cent. above the limiting current they will fuse within one minute. The actual time required for fusion shall be taken as a measure of the "time element" of the fuse.

(*g*) *Standard Rated Currents and Voltages.*—Every fuse shall be clearly marked with its rated current and the maximum voltage for which it is suitable. The standard rated currents and voltages suggested are as follows:—

Maximum Voltage, 250.—2, 4, 6 and 10 amperes.

Maximum Voltage, 500.—2, 4, 6, 10, 15, 20, 30, 40 and 50 amperes.

3. (*h*) *Temperature Rise.*—When loaded continuously with 80 per cent. of the limiting current, no exposed part of any fuse fitting shall attain a temperature exceeding 100° C. above that of the atmosphere.

(*k*) *Insulation.*—Fuse fittings shall be tested for insulation between terminals with the fusible portion removed, and between the live parts and "earth" with the fusible portion in place.

(*l*) *Operation.*—Fuses shall be tested for satisfactory operation on overload and short circuit in accordance with the specified arrangements for carrying out such tests.

Discussion.

Mr. J. F. Crowley thought that it was desirable that fuses should be so standardised that it was impossible for one of the wrong capacity to be put in circuit. He had known cases in which fuses had been put in circuit where the strength of the fuse was equal to that of the wiring. He thought the test period should be increased to six hours or even more. He would like a better definition of the short-circuit test. The capacity of the circuit and also its inductance must be taken into account.

Mr. A. E. Gott thought that the author expected rather too much of fuses, and that the overloads which he allowed on his fuses before they blew were rather too small. A fuse should not be expected to save plants from overloads which if continued would injure them, its proper function was to save them from destruction under abnormal conditions. Where small margins of operation were required, the right thing was to use circuit-breakers. The economical fuse of the future would probably be a fraction of an inch in length, but with a mechanical means for increasing the gap at the moment of fusion. The porcelain which formed the body of the fuse as a general rule was of bad quality, and it would

probably pay manufacturers to go to some trouble to get a suitable variety for the purpose.

Mr. Lindsay Foster said that he had found, when using asbestos-covered wire for fuses, that the explosion, when a fuse blew, was much less violent, and he had not had a case of difficulty for some time. Regulations for the interchangeability of fuses would be of great value, but the day for them had not yet arrived.

Dr. Kloss said the fixing by the supply company of a definite minimum length between the poles of a fuse was all very well with the old type of fuse, which, when it blew, produced an arc, but it was not right that such restrictions should be made to apply to fuses in which there was no arc produced. It was important in drafting specifications not to stick to certain words which had been in use in past times, but always to specify what was required—the object and not the means.

Mr. Shaw said that, with the larger currents, it was generally the case that the man in attendance was not incompetent. He had known a case in which a 10-ampere fuse was originally installed and found to be too small. Owing to the non-interchangeability, they had had considerable trouble in substituting a larger size for it.

Mr. A. M. Taylor believed that where the fuse was connected to bus-bars with a large amount of power behind, the rush of current on short-circuit might be simply enormous, and far greater than anything shown on any of their instruments. He had made some rough calculations of the rate at which the temperature of a fuse would rise on short-circuit with definite currents flowing, and he had come to the conclusion that it was not possible for a fuse to blow in the short interval of time frequently observed, unless the rush of current was very great indeed.

The Chairman believed that any standardising of fuses would lead to even more tampering with circuits than there was now.

Dr. D. K. Morris (Coventry) in a written communication referred to the remarkable way in which the thermally operated time-element circuit-breaker meets the conditions of the author's specification. The thermal breaker, being operated at a low temperature rise, is quite permanent in its rating. The rated current can be as much as 80 per cent. of the limiting current (as compared with 50 per cent. for a good fuse). The watts lost in the thermal strips is approximately one-fifth that of a fuse, and the temperature rise is, say, 50° not 100° C. As a means for breaking a circuit the thermal breaker can be properly designed to meet severe conditions—with carbon and auxiliary metal break or magnetic blow-out. In addition, the circuit is always ready for immediate closing without the delay that arises in replacing and rewiring a fuse.

Mr. Kefford (in reply) thought that Mr. Taylor had arrived at his remarkable results owing to his having neglected to take into account the rise in resistance of the copper with the temperature, which would greatly decrease the time taken to blow the fuse and bring the results of calculation and observation into line. As for the question of standardisation, if the time had not now arrived he really did not know when it would. The gauge ring could be easily altered if one had the key. To the ordinary user there was, however, nothing to show that it was not a part of the fitting. At the close of the meeting Mr. Kefford showed some interesting experiments which related particularly to the new type of fuse being introduced by Messrs. Siemens Bros. For the suitably arranged bank of lamps, he showed how very closely these fuses were calibrated. In a further experiment he showed that this fuse would open a circuit safely, even in an explosive mixture of gas and air.

Public Lighting from a Municipal Point of View.

By J. Abady.

(*Abstract of paper read before the* Institution of Gas Engineers, *London, June*, 1910.)

Severe competition prevails between gas and electricity for public lighting, but for a given light, distributed in a certain manner, it is immaterial which is employed, the sole consideration of importance being the question of relative cost. Contracts are made on three bases; for energy and maintenance, payment being made for energy and not for light; for energy only, maintenance being undertaken by a separate contractor or by the municipal authority; and for the supply of light, irrespective of the energy consumed. The chief points to be observed are the due observance of the terms of contract, the efficient maintenance of the standard of lighting, and the provision of facilities to encourage the introduction of improved methods during the contract period, whether to reduce the cost or obtain a better light. It should be to the advantage of both parties to adhere to the terms of the contract.

When the contract is for energy and maintenance, great difficulties arise in the determination of the amount of energy supplied, whether gas or electricity be used; and while the terms of the contract for maintenance may be adhered to literally, a poor illumination may nevertheless be obtained. There is also no inducement for the contractor to introduce more economical but more efficient methods of lighting, as the municipality as a rule would insist on the supply of the energy contracted for, regardless of the better lighting offered by the improved apparatus. This kind of contract, therefore, is opposed to the public interests.

If energy only is purchased, the municipality retaining control over maintenance, the difficulty of measurement remains, and the arrangement is also unfair to the supplier of energy, whose interests are at the mercy of the undertaker of maintenance. The latter, however, is in a position to improve the lighting by the adoption of improved burners or lamps, provided that the amount of energy contracted for is not reduced. This is likely, on the one hand, to prove a more expensive system than the previous one, or, on the other hand, to permit of a cheeseparing policy, resulting in inefficient lighting at the expense of the contractor's reputation.

The third system disposes of the difficulty of measuring the energy supplied, but introduces the necessity of testing the burners, which raises the questions whether the manner of applying the photometer test ensures an adequate fulfilment of the contract, and whether a photometer test is sufficiently definite and certain. The candle-power may be specified to be measured at two angles—20° and 50° to the horizontal—the average being taken; this avoids questions relating to the nature of the illuminant, and it happens also that in the majority of cases, whether gas or electricity is used, the mean of the light given at 20° and 50° practically coincides with the mean hemispherical intensity. Definition of the light by a foot-candle test is out of the question, all kinds of difficulties being introduced, about which photometrists themselves are not agreed. The test involves only the light of the lamp itself, and the photometer, and certain candle-powers on columns of certain heights being specified, in the competitive sense it is a question of price against price for the supply of the same light, without any quibble whatever. For the photometer, an instrument based upon the law of inverse squares appears to be satisfactory, and there is no difficulty in agreeing upon definite primary and secondary standards of light. It is advisable to define the weather in which official tests are permissible, and to permit the presence of a contractor's representative; and if one lamp is found to be below the standard, the average of the two lamps nearest to it, together with the defective lamp, should be taken. Experience in Westminster during five years shows that there is no practical difficulty in the working of a test clause of this nature.

The problem of efficient maintenance is also solved, and there is no impediment to the introduction of improved methods.

Judging from specimens of street lighting, it is evident that the selection of suitable units, their proper arrangement, and the general distribution of light are very imperfectly understood, and the crudest and most harmful contrasts of lighting are often seen. The distribution of light from a given source depends upon the height of the source and the proportion of light emitted at different angles; these factors being known, the distribution can be calculated. Tables I and II facilitate these calculations. Table I shows

TABLE I.

Height of light from ground.		Angle of depression from horizontal 80°	70°	60°	50°	40°	30°	20°	15°	10°
11 ft.	(a)	1·9	4·0	6·35	9·3	13·1	19·0	30·2	41·0	62·37
	(b)	11·17	11·7	12·7	14·35	17·1	22·0	32·15	42·46	63·36
	(c)	124	136	161	206	292	484	1,033	1,802	4,014
12 ft.	(a)	2·1	4·37	6·92	10·0	14·3	20·75	33·0	44·8	68·0
	(b)	12·184	12·76	13·84	15·66	18·66	24·0	35·0	46·3	69·1
	(c)	148	162	191	245	348	576	1,227	2,145	4,777
13ft. 6 in.	(a)	2·36	4·9	7·79	11·3	16·0	23·35	37·0	50·4	76·5
	(b)	13·7	14·36	15·58	17·61	21·0	27·0	39·5	52·1	77·8
	(c)	187	206	242	310	441	729	1,557	2,715	6,046
15 ft.	(a)	2·64	5·46	8·65	12·58	17·85	25·9	41·2	56·0	85·0
	(b)	15·23	16·0	17·3	19·57	23·3	30·0	43·8	58·0	86·4
	(c)	232	256	299	383	544	900	1,921	3,352	7,465
20 ft.	(a)	3·52	7·28	11·54	16·78	23·8	34·6	55·0	74·6	113·4
	(b)	20·3	21·28	23·0	26·0	31·1	40·0	58·46	77·2	115·2
	(c)	412	452	532	681	967	1,600	3,417	5,960	13,225
25 ft.	(a)	4·4	9·1	14·4	21·0	29·7	43·25	68·7	93·3	141–75
	(b)	25·4	26·6	28·8	32·6	38·8	50·0	73·0	96·5	144–0
	(c)	644	707	832	1,064	1,511	2,500	5,339	9,312	20,736
Ratio of (c) 80° = 1		1	1·1	1·28	1·64	2·34	3·88	8·27	14·4	32·2

Table of Measurements at Various Angles.

(a) = distance from column
(b) = distance from light centre to the ground
(c) = the square of (b)

All distances are in feet.

TABLE II.

Feet from ground (proposed new column)		11·0	12·0	13·6	15·0	20·0	25·0
Feet from ground (existing column)	11·0	—	1·2	1·5	1·8	3·3	5·0
		—	*1·07*	*1·21*	*1·33*	*1·78*	*2·24*
	12·0	·8	—	1·26	1·6	2·8	4·3
		·93	—	*1·13*	*1·24*	*1·66*	*2·09*
	13·6	·66	·8	—	1·23	2·2	3·4
		·82	*·88*	—	*1·1*	*1·47*	*1·84*
	15·0	·54	·64	·8	—	1·8	2·8
		·75	*·8*	*·91*	—	*1·34*	*1·67*
	20·0	·3	3·6	·45	·56	—	1·5
		·56	*·6*	*·68*	*·74*	—	*1·25*
	25·0	·2	·23	·3	·36	·64	—
		·445	*·48*	*·54*	*·6*	*·8*	—

Note.—The top row of figures shows the ratio of increased light required to yield the same illumination of ground area if one height of light centre is substituted for another.

The figures in italics show the increased length of road which will be illuminated if one height of light centre is substituted for another. The proportion varies somewhat with "hit or miss" lighting as the road widths vary, and the above figures are, therefore, approximate.

the proportional distribution of light along the ground from light sources at given heights; Table II, the effect of varying the height. It will be seen that the light from a single lamp falls off as the angle diminishes, and as the height is increased. Mere comparisons of total candle-power employed are totally fallacious. To give the best distribution of light, lamps giving a large proportion of light at angles approaching the horizontal, aided by dioptric globes or reflectors, may be used. A large number of polar curves for gas and electric lamps is given in the paper, showing how far the desired object is attained in practice; the "Excello" flame arc in a dioptric globe, giving the maximum intensity at 10°, is commended as the best example, high-pressure incandescent gas burners in lanterns coming next.

Tables showing the normal illumination produced by the various sources at different distances are also given. When the lamps are so far apart that the 10° rays meet on the ground, the variation in

TABLE III.

Height of light.	10° meeting 10°.	15° meeting 15°.	15° meeting 20°.	20° meeting 20°.
11 ft. ...	125 ft. ...	82 ft. ...	72 ft. ...	60 ft.
12 „ ...	136 „ ...	90 „ ...	78 „ ...	66 „
13 „ 6 in. ...	153 „ ...	101 „ ...	88 „ ...	74 „
15 „ ...	170 „ ...	112 „ ...	98 „ ...	82 „
20 „ ...	227 „ ...	150 „ ...	130 „ ...	110 „
25 „ ...	284 „ ...	187 „ ...	162 „ ...	138 „

illumination is very great, even in the best cases; a great improvement is effected by bringing the lamps closer together, so that the 20° rays meet. This may be too costly (although the candle-power of the lamps may be decreased); but it offers an ideal to be approached as nearly as possible. Table III gives the distances apart of lamps at various heights and overlapping more or less. No rigid standards can be laid down, and different arrangements must be adopted according to local conditions.

THE SITUATION OF THE GERMAN ELECTRICAL INDUSTRY.

THE active interest which has been manifested for some time past in respect of the position of, and outlook for, the German electrical engineering industry, recently induced the *Kolnische Zeitung* to make inquiries of the principal manufacturing firms on the subject. As a result, it has been ascertained that agreement substantially exists in regarding the future with confidence, differences of opinion only prevailing on points of detail. It is especially noteworthy of the situation, as a whole, that the electrical industry has practically had no share in the crisis which started to affect unfavourably the position of trade in general at the end of 1907, although individual firms carried out unsatisfactory transactions in 1908 and 1909, which concerned themselves alone. But in the case of the leading makers who work on a sound basis and know how to estimate correctly, the orders received constantly increased from the standpoint of numbers and weight of output in tons, but if calculated in money decreases were experienced in some instances, particularly after the heavy decline in the price of copper, as materials became so much cheaper that the larger tonnage represented a smaller value. At the same time the total augmentation in the turnover resulted in higher profits, as is shown by the advance in the dividends paid in the past few years.

The present year, according to the replies made to the inquiries, has witnessed a further slight increase in the orders booked for dynamos, motors and transformers, as well as for material for installations. But in the case of cables, the effects of the three months' interruption in the existence of the Cable-Makers' Syndicate early in 1909 are still felt. During that period the quantity of cable which was bought and sold at very low prices was so considerable that it has as yet been impossible quite to reach the normal turnover in regard to fresh orders. Apart from this circumstance, business in turbines, electricity meters and lamps is also advancing, and the general orders received for plant from the manufacturing industries show that the latter are being equipped for brisker times. On the other hand, the degree of employment for the export markets continues unsatisfactory, and it is contended that the existing German treaties of commerce have prejudiced the export trade and have proved to be a failure.

The zeal exhibited in regard to overland central stations, it is further pointed out, occupies not a small share in connection with orders for the home market, now that central stations have been developed in all towns of any importance. But the fervour in this respect seems to have advanced to a stage which is not quite unobjectionable. At the present time over one hundred overland central stations are projected. Each individual rural district would like to possess a central station of its own, and it will soon be easier to count the number of districts which have no station, or do not wish for one, than those which desire to establish a supply. The self-delusion which is committed in this direction is based less upon erroneous notions as to the expected connections than in regard to the actual consumption. Agricultural interests in particular are requested to take into consideration the circumstance that the relation between connections and demand for current is nowhere so unfavourable as in agriculture, whilst the business difficulties with which overland stations have to reckon should not be underestimated. The management should not be of a bureaucratic character, but should be arranged according to the principles of a business company, so that the form of a company is desirable for an overland station. Where stations cannot depend upon a sufficient circle of consumers, it will be scarcely possible to avoid disillusions. But where agricultural consumption is united with that for towns and industries, such reaction will be prevented, and a satisfactory development may be expected. As an instance of a station erected with this point in view, is mentioned that of the Markische Elektrizitätswerk, near Eberswalde, which has customers of the three classes in question, whilst a further development would be the supply for railway working, as is proposed in connection with the station projected for the conversion of the Dessau-Bitterfeld line to electric traction.

The question of electric railways, which is next referred to, is stated to be prominently represented at present, among others, by the work of carrying out the Hamburg municipal network, and the underground railway between Schoneberg and Berlin, and other towns also seem to be taking an interest in the establishment of high-speed lines. On the other hand, the electrification of main lines in Germany is tolerably quiet, owing principally to the fact that expenditure for railway purposes is being avoided as far as possible, having regard to the momentary financial situation of the country; but as contrasted with this general belief, individual opinions exist to the effect that greater confidence may now be manifested on the subject of the conversion of lines than has hitherto been the case. The whole situation may be summarised by the statement that no unfavourable predictions are entertained in interested circles as to the future. The increase in the volume of orders, the belief that various large towns will proceed with high-speed lines, and the idea that the depression in railway construction and working will come to an end, are indications of progress, and although prices will presumably remain unfavourable, it is considered that they must be counteracted by careful organisation of the methods of manufacture and enterprise.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PORTUGAL—PORTUGUESE INDIA.

Machines for industrial purposes; railway rails; locomotives; telegraph and telephone material...	Free.
Copper wire	3 reis per seer.
Copper manufactures	4 tangas per seer.
Iron wire, galvanised or not	¾ reis per seer.
Articles not mentioned in the tariff	14 % ad val.

16 tangas = 192 reis = 2s. Seer = $2\frac{1}{16}$ lb.

PORTUGAL—LOURENCO MARQUES.

Machines for industry; railway carriages, rails, &c.	Free.
Glassware, common...	3 % ad val.
„ not specified	5 % „
Goods not mentioned in the tariff	3 % „

In addition to the ordinary Customs tariff, a commercial contribution of 3 per cent. *ad valorem* is levied on all goods, and a municipal tax of 25 per cent. of the amount payable as import duties.

PORTUGAL—MOZAMBIQUE.

Machines for industrial purposes; scientific instruments and apparatus; railway carriages and rails	Free.
Rubber manufactures	500 reis per kg.
Copper wire	50 „ „
Copper manufactures	200 „ „
Iron wire, galvanised or not	3 „ „
Glassware	150 „ „
Goods not mentioned in the tariff...	5 % ad val.

1,000 reis = about 4s.

Co-operative Lighting.—Referring to the correspondence on this subject in recent issues, the JANDUS ARC LAMP AND ELECTRIC CO., LTD., state that the method of subdividing the arcs required on a series circuit amongst different consumers has usually resulted in trouble. The differences in the hours of lighting required by different trades, and the possibility of any one shop of the series closing, usually creates friction amongst the co-operative partners, and adds another worry to the difficulties of the station engineer. The company has latterly placed upon the market a pattern of its regenerative lamp taking a current of 2½ to 3 amperes, and burning direct on 200 to 240 volts D.C. The efficiency of this lamp is stated to be within a few per cent. of the efficiency given by the regenerative arc when burning either two or four in series on 220 volts, and burning 80 hours with one trim, and by its use the problem in question would appear to be effectually solved.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,597. "Improvements in electrically-actuated brakes." W. Cross. (F. Krizik, Austria.) July 25th. (Complete.)

17,634. "Improvements in and relating to instruments for measuring the intensity and variations in the intensity of magnetic fields." L. D. J. A. Dunoyer. (Date applied for under Sec. 91 of the Act, August 18th, 1909, being date of application in France.) July 25th. (Complete.)

17,641. "Improvements in secondary batteries or storage cells." V. de Karavodine. July 25th.

17,650. "Electric furnace with a receptacle for the charge arranged on the enlarged furnace chamber." A. Helfenstein. (Date applied for under Sec. 91 of the Act, July 27th, 1909, being date of application in Austria.) July 25th. (Complete.)

17,658. "Improvements relating to electric switches." R. F. Venner and R. C. Griesbach. July 25th.

17,684. "Improvements relating to resistances for electric heating apparatus." R. F. Venner. July 26th.

17,686. "Improvements in galvanic batteries." F. Richmond. July 26th.

17,690. "Apparatus applicable to electrical tramcars for maintaining the guide rope during transit and the trolley pole after disconnection from the live wire in safe positions." R. Ashworth. July 26th.

17,694. "Improvements in electrical fuses." W. A. Malson. July 26th.

17,731. "Improved arrangements for controlling the speed of induction electric motors." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) July 27th. (Complete.)

17,745. "Improvements in and relating to spark plugs for internal combustion engines and the like." L. B. Cherry. (Date applied for under Sec. 91 of the Act, January 17th, 1910, being date of application in United States.) July 26th. (Complete.)

17,759. "Improved means for laying and picking up field telephone lines and the like." E. Leate. July 26th. (Complete.)

17,818. "Improvements in fusible cut-outs for controlling electric circuits." V. Hope. July 27th.

17,819. "Improvements in electrical cord grips." M. H. Goldstone and J. Lightfoot. July 27th.

17,837. "Process of electro-plating without a battery." C. M. MacFarlaine. July 27th.

17,873. "Improved means and appliances for removing and replacing electric light or like bulbs in their sockets." F. C. Upton. July 27th.

17,874. "Improvements in or relating to electric traction systems." E. M. Munro and Railless Electric Traction Co., Ltd. July 27th.

17,902. "Adjustable reflector or screen of glass, metal, or other material for use as a screen or reflector for electric or other source of artificial light." T. O. Belshaw. July 27th.

17,904. "Improvements in electric switches of the quick make and quick break type." P. W. Scholefield. July 28th.

17,917. "Improvements in apparatus for making copies of tracings and the like by means of electric light." F. W. J. Alliott and F. L. Cheers. July 28th.

17,991. "Improvements in connection with the generation of electric energy and apparatus therefor." W. S. Simpson. July 28th.

17,994. "Improvements in automatic telephone exchange circuits." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt-Ges., Germany.) July 28th. (Complete.)

17,995. "Control devices for electric cars on routes in which two different voltages are supplied." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke, G.m.b.H., Germany.) (Complete.)

18,012. "Improvements in or relating to contact mechanism for the automatic stopping of machines." V. Hallstream. July 28th.

18,054. "Improvements in inductive wireless telephone installations." H. von Kramer. July 29th.

18,073. "Improvements relating to a system of cutting out or electrically interlocking sockets and plugs in electric circuits." E. E. Rogers. July 29th.

18,087. "Improved means for preventing oil from being drawn into the bearings of electrical and similar machines." W. M. Kermode, C. St. C. Plummer and W. O. Pepper. July 29th.

18,095. "Improvements in magneto electrical machines." Firm R. Bosch. (Date applied for under Sec. 91 of the Act October 15th, 1909, being date of application in Germany.) July 29th. (Complete.)

18,098. "Device for use in connection with a telephone to facilitate the recording of calls and messages." S. J. Sewell. July 29th.

18,115. "Improvements in or relating to electrical heating apparatus." A. F. Berry. July 29th.

18,136. "Improvements in electrical heaters or stoves of the radiator kind." Veritys, Ltd., and W. G. Pipkin. July 30th.

18,151. "Improvements in or relating to winding apparatus for coils or the like for electrical or other apparatus." E. Haefely. July 30th. (Complete.)

18,190. "Improvements in or relating to controllers for electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) July 30th. (Complete.)

18,191. "Improvements in or relating to electric motor controllers." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) July 30th. (Complete.)

18,195. "Improvements in and relating to dynamo-electric machinery." Brown, Boveri & Co., Ltd. (Akt-Ges. Brown, Boveri et Cie., Switzerland.) July 30th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

Automatic Electric Regulators, Output Adjusters, and the like. H. Leitner. 15,889. July 7th.

Insulation of Electric Conductor Windings or Coils made of Aluminium or Aluminium Alloys. R. Kuttner. 15,896. July 7th.

Phototelegraphy. T. T. Baker and Pictorial Newspaper Co. 15,518. July 7th.

Process for the Production of a Metallic Connection between Incandescent Filaments and their Leading-in Wires. Pope's Electric Lamp Co. (C. Trenzen.) 16,076. July 9th.

Controlling Mechanism of Automatic Electric Lifts. Electromotor Equipment Co. and T. Barlow. 16,114. July 10th.

Electric Impulse or Step-by-Step Clockwork Mechanism. I. H. Parson and A. E. J. Ball. 16,117. July 10th.

Automatic Electric Switches. T. Ferguson. 16,273. July 13th.

Windings for the Armatures of Dynamo-Electric Machines and the like. A. G. Hopper and J. E. H. Greenwood, executors of the late A. Greenwood, and Chapman. 17,354. July 24th.

Means for Preventing Overwinding and Underwinding Electrically-driven Cranes, Capstans, Lifts and the like. H. Wardale and W. R. Storey. 17,516. July 28th.

Electric Lamp for Miners and for the House. S. Kraus. 18,864. August 16th.

Electrodes for Arc Lamps. British Thomson-Houston Co. (General Electric Co., U.S.A.) 18,965. August 17th.

Elastic Electromagnetic Power-Transmitting Device, particularly for use with Automobiles, Locomotives and the like. W. Dmitriew. 20,296. September 4th.

Flexible Electrical Brushes or Collectors. R. H. Barbour. 21,180. September 16th.

Electrical Switches. N. Collins. 24,373. October 23rd.

Electro-Deposition Apparatus. A. F. Harris. 24,735. October 28th.

Conduits or Casings suitable, *inter alia*, for Electric Wiring Systems. A. E. Woodhouse. 25,577. November 5th.

Systems of Electric Motor Control. British Thomson-Houston Co. (General Electric Co., U.S.A.) 28,941. December 10th.

Electric Meters. British Thomson-Houston Co., J. Gray, R. H. Rogers and H. Holden. 30,142. December 24th. (Application for Patent of Addition to No. 12,689 of 1909.)

Apparatus for Electrolytically Removing the Grease from Objects to be Galvanised. H. W. T. Schulte. 30,463. December 30th.

1910.

Electrolysis of Metallic Solutions. F. Lacroix. 845. January 12th.

Apparatus for obtaining High Continuous Potential Differences. J. Delon. 847. January 12th. (Date applied for under International Convention, January 16th, 1909. Application for Patent of Addition to 1,070 of 1909.)

Electric Lamp Shades or Reflector Attachments. H. D'Olier. 4,425. February 22nd.

Pendants for Electric Lamps and Gas Burners. A. Docking. 5,735. March 8th.

Electric Circuit Closers. H. C. Thomson. 4,318. February 31st.

Multiple Switch Devices for Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 5,261. March 2nd.

Electrolytic Apparatus having a Liquid Annular Anode. Schott & Gen. 6,596. March 16th. (Date applied for under International Convention, March 30th, 1909. Application for Patent of Addition to No. 14,288 of 1909.)

Current Terminals for use in the Manufacture of Mirrors by Electro-deposition. A. G. Bloxam. (Firm of E. Hoorickx & A. Hindel.) 7,641. March 29th. (Application for Patent of Addition to No. 2,490 of 1909.

Electric Heating Apparatus. British Thomson-Houston Co. (General Electric Co., U.S.A.) 7,860. March 21st.

Control of Electric Motors. Allgemeine Elektricitäts Ges. 10,607. April 2/th. (Date applied for under International Convention, April 30th, 1909.)

Electric Switches. H. R. Schultz. 12,522. May 23rd. (Date applied for under Rule 13, July 24th, 1909.)

Engineering Education.—Our readers do not require to be told that there is a deplorable want of standardisation in the matter of engineering education. It is a matter which has of late years engaged the attention of educationalists, and many schemes have been proposed with a view to meeting the changed conditions which the growth of labour-saving machinery has brought about. There have been attempts to revive the old-fashioned form of apprenticeship, but those who are in close touch with engineering matters feel that this is now an impossible state of things. In the old days when manual dexterity was the chief essential in the manufacture of engineering appliances, a long workshop apprenticeship was a *sine qua non* to the engineer; but nowadays equal, if not greater, importance must be given to the technical education of engineering aspirants. The matter has lately come under the consideration of the Engineering Society of the City of Cardiff Technical School, and as a result of their deliberations the following resolution has been submitted to the Cardiff Technical School Committee:—

"That in view of (*a*) the very large number of youths who nowadays seek to become engineering apprentices; (*b*) the very large number of trained youths who, from financial considerations, find it impossible to become apprenticed; and (*c*) the relatively large number of 'premium' apprentices, who, through inadequate disciplinary restraint, tend to lower the status of the profession or trade of the engineer: this Committee hereby recommends the Association of Technical Institutions to take such action (in combination with employers, Trade Unions, the Board of Education and the Board of Trade) as will have for its objects:—

"1. The adoption of a definite standard of educational attainment to be reached by all youths desirous of becoming apprenticed as engineers.

"2. The adoption of a definite standard of educational attainment to be reached before anyone engaged in an engineering profession be recognised as a trained engineer.

"3. The remodelling of the syllabuses of the Board of Trade for the examination of marine engineers in such a way that all candidates shall be required to have successfully undergone during their apprenticeship a course of technical training approved by the Board of Education."

It will be noted that the Committee recommends the Association of Technical Institutions to take combined action with employers, Trade Unions, the Board of Education and the Board of Trade, and there is no doubt that some combined action of this sort might have the effect of bringing about some degree of uniformity in the methods of engineering instruction.